# VEGETATION OF AMERICAN MEMORIAL PARK

## SAIPAN, MARIANA ISLANDS

PREPARED FOR NATIONAL PARK SERVICE

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## INTRODUCTION

American Memorial Park is an affiliated status subunit of War in the Pacific National Historical Park located on the island of Saipan, Northern Marianas. The park, established in 1978, commemorates American soldiers who lost their lives in the campaign on Saipan during the Second World War.

The park is a small area, 133 acres. It is a coastal area located just north of Garapan on a raised reef (Fig. 1). The focus of the Park is the modest memorial which is surrounded by a substantial recreational area. There is a small wetland within the Park's boundaries which has been manipulated over the years. Since the war, bulldozing and use of the area as a dump continued until 1978. The waste material was covered over and the area left untouched since then. A dense vegetation has taken over the area which is now the habitat of the endangered Marianas gallinule and a large number of other birds.

In 1982, the Northern Marianas government requested the U. S. Army Corps of Engineers to develop a flood control program for Garapan. Three of the options presented would directly affect the wetland area. The National Park Service became concerned about the impact of the preferred flood control option on the stability of the endangered gallinule habitat. They requested an inventory of the botanical resources of the park with some detailed quantitative measurements of the vegetation within the wetland area.

## METHODS AND MATERIALS

General plant survey. Plants were collected from all areas of the site during the initial survey of the wetland park in 1986, the subsequent surveys in 1988 and early 1989. Voucher specimens were collected for each plant species and have been curated at the University of Guam Herbarium. Some duplicates are deposited at Bishop Museum, Honolulu, and the National Museum of Natural History (Smithsonian Institute), Washington, D.C. Species are shown in table 1.

Transect. Quantitative measurements of the vegetation were collected using the line intercept method along four transects in the wetland area (Mueller-Dombois and Ellenberg 1974, Brower and Zar 1984). The locations of the transects are indicated on the map (Fig. 2). The importance value data are presented in Table 2; raw data can be seen in Appendix 1.

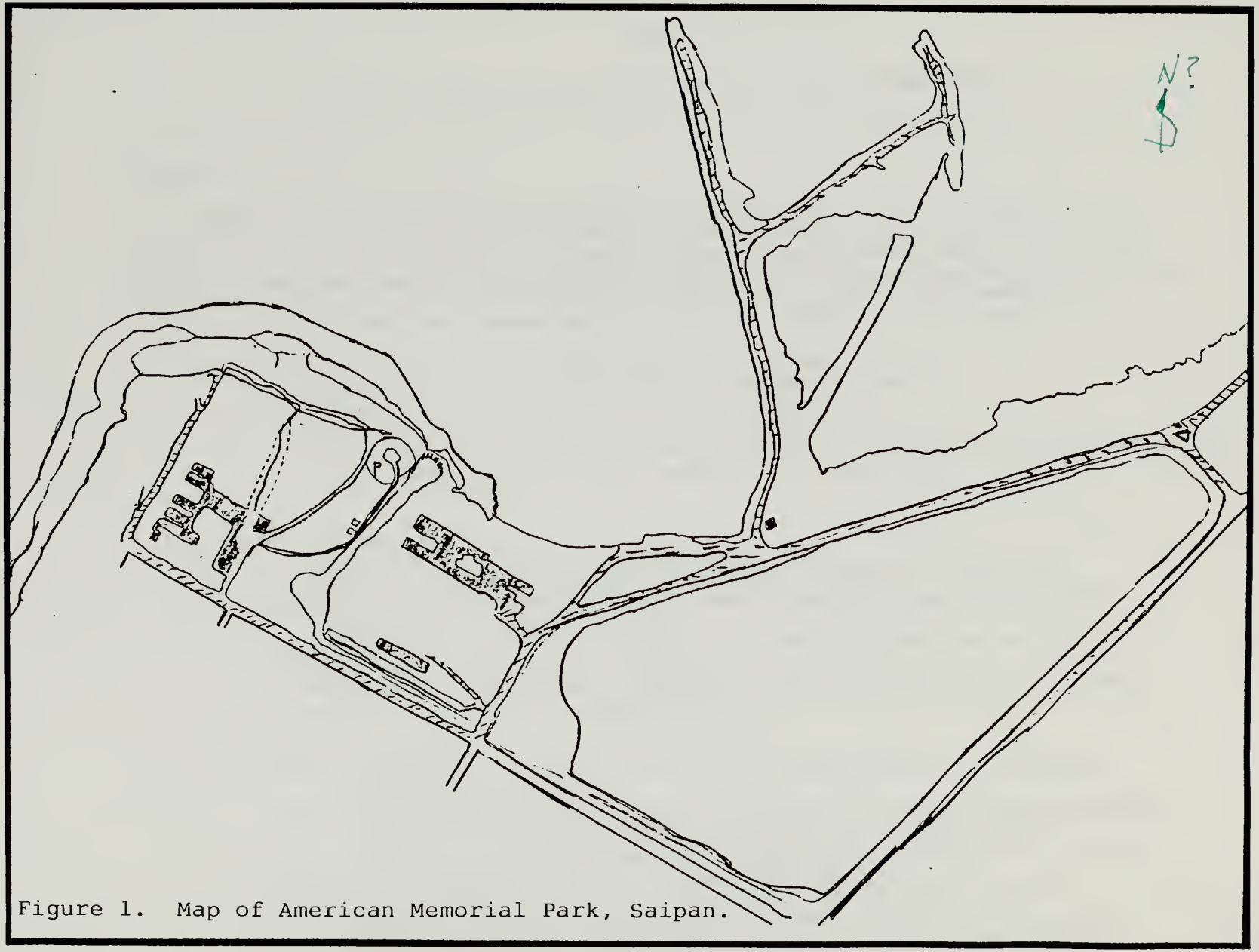


Figure 1. Map of American Memorial Park, Saipan.

TABLE 1

Vascular Plants of American Memorial Park, Saipan CNMI

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Legend:

I. Information relates to classification of the plant. Words in caps show categories as large as FAMILY, or larger. Family names typically end in -CEAE. Capitalized, underlined words are genera (genus names); lower case, underlined words are species names. The scientific names are the genus-species combinations. Names/abbreviations after scientific names are the person(s) who named the species. Other names are common names, including Chamorro local names.

II. Growth form refers to the appearance of the plants.
- H= herbaceous; plants with little or no woody growth.
- S= shrubs; woody plants with several major trunk.
- T= trees; woody plants with one major trunk.
- V= vines; woody or non-woody plants which can not stand free by themselves, but variously crawl, creep, sprawl, and climb over other vegetation.

III. Place in community.
- T= terestrial; rooted in relatively dry soil.
- A= aquatic; rooted, floating or emergent in watery situations.
- E= epiphytic; attached to the surface of another plant, and using that plant for support, only.
- P= parasitic; unrooted but attached to another plant and utilizing its food as well as its support.
- S= saprophytic; nutrition is gained from dead and decaying vegetable matter, and not by photosynthesis.

IV. Status. The relation of the plant to the site.
- Nd= indigenous - native to the site; evolved there, or arrived by natural transport.
- Nd/E= indigenous/endemic - native to the site, and not found elsewhere unless so specified (Nd/Eo*= Saipan; Mariana Is., etc.)
- Nt= introduced - brought in, accidentally or deliberately, by man or his agents (planes, canoes, dogs, etc.).
- Nt/N= introduced/naturalized - behaves as an indigenous species; prospers without the assistance of man.
- Nt/X= introduced/exotic - survives or spreads only if man assists.

Legend for Table 1

V. Relative abundance. Comparative numbers in the communities which the species occur(s). /C= Clumped - a modifier used to indicate very uneven spacing species like grasses, etc. A species may occur only one place in a site, but several plants will be close together (R/C).

R= Rare - less than 5 plants per 100 m2 in sites where they occur.
U= Uncommon - more than 5 but less than 20 plants per 100 m2 in sites where they occur.
C= Common - more than 20 but less than 50 plants per 100 m2 in sites where they occur.
A= Abundant - more than 50 plants per 100 m2

TABLE 1

Vascular Plants of American Memorial Park, Saipan, CNMI

| I. | II. | III. | IV. | V. |
|---|---|---|---|---|
| FERNS - OPHIOGLOSSACEAE | | | | |
| *Ophioglossum nudicaule* L.f. | H | T | Nd | R |
| FERNS - POLYPODIACEAE | | | | |
| *Acrostichum aureum* L. Langayao; Giant swamp fern | H | A | Nd | U/C |
| *Antrophyum plantagineum* (Cav.)Kaulf. | H | E | Nd | R/U |
| *Davallia solida* (Forst. f.)Sw. Pugua machena | H | T,E | Nd | U |
| *Nephrolepis hirsutula* (Forst.) Presl. | H | T,E | Nd | C |
| *Polypodium punctatum* (L.)Sw. Bird's nest fern | H | E | Nd | U |
| *Polypodium scolopendria* Burm. f. | H | T.,E | Nd | C |
| *Pteris vittata* L. | H | T | Nt/N | U |
| *Pyrrosia lanceolata* (L.) Farw. | H | E | Nd | C |
| *Tectaria crenata* Cav. | H | T | Nd | U |
| *Thelypteris opulenta* (Kaulf.) Fosb. | H | T | Nd | R |
| *Vittaria incurvata* Cav. Shoestring fern | H | E | Nd | R/U |
| FERNS ALLIES - PSILOTACEAE | | | | |
| *Psilotum nudum* (L.) Grisebach Whisk fern | H | T,E | Nd | R |

TABLE 1 continued

| I. | II. | III. | IV. | V. |
|---|---|---|---|---|
| - ARACEAE | | | | |
| Alocasia macrorrhiza (L.)Schott | H | T/A | Nt | R/U |
| MONOCOTS - ARECACEAE (PALMAE) | | | | |
| Cocos nucifera L. Niyog; Coconut | T | T | Nt/N | U |
| MONOCOTS - CYPERACEAE | | | | |
| Cyperus brevifolius (Rottb.) Hassk. | H | T | Nt/N | U |
| Cyperus compressus L. | H | T | Nt/N | U |
| Cyperus difformis L. | H | A/T | Nt/N | U |
| Cyperus kyllingia Endl. | H | T,A | Nt/N | U |
| Cyperus polystachyos Rottb. | H | T,A | Nd | U |
| Fimbristylis cymosa R. Br. | H | T | Nd | U |
| MONOCOTS - GRAMINEAE (POACEAE) | | | | |
| Cenchrus echinatus L. Bur-grass; Sandspur | H | T | Nt/N | U |
| Chloris inflata Link Fingergrass | H | T | Nt/N | C |
| Chrysopogon aciculatus (Retz.)Trin. Inifuk; Palaii | H | T | Nd | U |
| Cynodon dactylon (L.) Pers. Bermuda Grass | H | T | Nt/N | C |

TABLE 1 continued

| I. | II. | III. | IV. | V. |
|---|---|---|---|---|
| MONOCOTS - GRAMINEAE (POACEAE) (con't) | | | | |
| Dactyloctenium aegyptium (L.) Beauv. | H | T | Nt/N | U |
| Dichanthium blahdii (Retz.)Clayton | H | T | Nt/N | U/C |
| Echinochloa colonum (L.)Link<br>Chaguan-Agaga; Jungle-Rice | H | T/A | Nd | U |
| Eleusine indica Gaertn.<br>Umog; Goose Grass | H | T | Nt/N | C |
| Eragrostis ciliaris (L.)R.Br. | H | T | Nt/N | C |
| Eragrostis tenella (L.) Beauv. ex Hook.<br>Lovegrass | H | T | Nt/N | C |
| Eragrostis sp. | H | T | Nt/N | U |
| Eustachys petraea (Sw.) Desv. | H | T | Nt/N | CU |
| Imperata conferta | H | T | Nt/N | U |
| Ischaemum sp. | H | T | Nt | R |
| Lepturus repens R. Br.<br>Lesaga | H | T | Nd | C |
| Panicum maximum Jacq.<br>Guinea grass | H | T | Nt/N | C |
| Panicum muticum Forssk. | H | T | Nt/N | C |
| Paspalum coniugatum Berg.<br>Hilo grass | H | T | Nt/N | U |
| Paspalum distichum L. (P. vaginalis Sis.)<br>Saltgrass; Knotgrass; Couchgrass | H | T | Nd | R |
| Pennisetum polystachion (L.) Schultes | H | T | Nt/N | U |
| Sporobolus fertilis (Steud.)Clayton<br>Wiregrass | H | T | Nt/N | C |

TABLE 1 continued

| I. | II. | III. | IV. | V |
|---|---|---|---|---|
| MONOCOTS - GRAMINEAE (POACEAE) (con't) | | | | |
| *Thuarea involuta* (Forst.) R. Br. Ex R. J.S. Las-aga | H | T | Nd | C |
| *Zoysia matrella* Var. *pacifica* Goudsew. Templegrass | H | T | Nd | U |
| MONOCOTS - LILIACEAE (sensu lato) | | | | |
| *Hymenocallis littoralis* (Jacq.) Salisb. | H | T | Nt/N | U |
| *Sanseviera* sp. Tigre; Bowstring Hemp | H | T | Nt/N | U/C |
| MONOCOTS - ORCHIDACEAE | | | | |
| *Spathoglottis plicata* Bl. | H | T/E | Nd | U |
| *Taeniophylum mariannense* Schltr. Kamuke-nanofe; Amot-otdon; worm orchid | H | E | Nd | U |
| *Zeuxine fritzii* Schltr. | H | T | Nd | U/C |
| MONOCOTS - PANDANACEAE | | | | |
| *Pandanus dubius* Spreng. Pahong; Screw Pine | T | T | Nd | U |
| *Pandanus tectorius* Park. Kafu; Screw Pine | T | T | Nd | C |
| DICOTS - ACANTHACEAE | | | | |
| *Blechum brownei* Juss. var. *puberlum* Yerbas babui | H | T | Nt/N | U/C |

TABLE 1 continued

| I | II. | III. | IV. | V |
|---|---|---|---|---|
| DICOTS - ACANTHACEAE (con't) | | | | |
| *Pseuderanthemum carruthersii* (Seem.)Guill. var. *carruthersii* | S | T | Nt | U |
| DICOTS - AMARANTHACEAE | | | | |
| *Achyranthes aspera* L.<br>Chichitun; Lasogado | H | T | Nt/N | U |
| *Deeringia amaranthoides* (Lam.)Merr. | V/S | T | Nd | U/C |
| DICOTS - ARALIACEAE | | | | |
| *Polyscias fruticosa* (L.)Harms<br>Papua | S/T | T | Nd | R |
| DICOTS - ASTERACEAE (COMPOSITAE) | | | | |
| *Bidens alba* (L.) DC<br>Daisy | H | T | Nt/N | C |
| *Eupatorium odoratum* | H | T | Nt/N | C |
| *Mikania scandens* (L.)Willd.<br>Mile-a-minute | V | T | Nt/N | C |
| *Pluchea indica* (L.) Less. | S | T | Nt/N | C/A |
| *Pluchea symphitifolia* (Mill.)Gillis | S | T | Nt/N | U/C |
| *Pluchea* x *fosbergii* | S | T | Nt/N | R |
| *Vernonia cinerea* (L.)Less.<br>Chaguan Santa Maria | H | T | Nt/N | U |

TABLE 1 continued

| I. | II. | III. | IV. | V. |
|---|---|---|---|---|
| DICOTS - BORAGINACEAE | | | | |
| *Heliotropium procumbens* var. *depressum* (Cham) Fosb. & Sachet<br>Hunig-tasi | H | T | Nt/N | U |
| *Tournefortia argentea* L.f.<br>Hunig; Beach Heliotrope | T | T | Nd | U |
| DICOTS - CARICACEAE | | | | |
| *Carica papaya* L.<br>Papaya | H,T | T | Nt/N | U |
| DICOTS - CASUARINACEAE | | | | |
| *Casuarina equisetifolia* L.<br>Gago; Ironwood; Australian Pine | T | T | Nd | C |
| DICOTS - CONVOLVULACEAE | | | | |
| *Ipomoea indica* (Burm.)Merr.<br>Fofgu; Asa-gao; Japanese Morning-glory | V | T | Nt/N | C |
| *Ipomoea macrantha* R. & S.<br>Alaihai; Moon Flower | V | T | Nd | C |
| *Ipomoea pes-caprae* ssp. *brasiliensis* (L.) v. Ooststr.<br>Alalag-tasi; Beach Morning-glory | V | T | Nd | C |
| *Ipomoea triloba* L.<br>Fofgu-sabana | V | T | Nt/N | C |
| *Operculina ventricosa* (Bert.) Peter<br>Alalag; Wood-rose | V | T | Nt/N | U/C |
| *Stictocardia tiliaefolia* (Desr.) Hall.f.<br>Abubo | V | T | Nt/N | U |

TABLE 1 continued

| I. | II. | III. | IV. | V. |
|---|---|---|---|---|
| DICOTS CUCURBITACEAE | | | | |
| *Momordica charantia* L.<br>Ahgaga; Bitter-mellon | V | T | Nt/N | U |
| DICOTS - EUPHORBIACEAE | | | | |
| *Acalypha indica* L.<br>Hierba del cancer; Island Catnip | H | T | Nt/N | U |
| *Euphorbia cyathophora* Murr.<br>Dwarf Poinsetta | H | T | Nt/N | U |
| *Euphorbia hirta* L.<br>Golodrina | H | T | Nt/N | U |
| *Phyllanthus amarus* Schum.<br>Maigo-lalo | H | T | Nt/N | U |
| *Phyllanthus marianus* Muell.-Arg.<br>Gaogao-uchan | H | T | Nd | U |
| DICOTS - GOODENIACEAE | | | | |
| *Scaevola sericea* Vahl.<br>Nanaso; Half-flower | S | T | Nd | U |
| DICOTS - HERNANDIACEAE | | | | |
| *Hernandia sonora* L.<br>Nonag | T | T | Nd | C |
| DICOTS - LABIATAE | | | | |
| *Hyptis* sp. | H/S | T | Nd | R/u |

TABLE 1 continued

| I. | II. | III. | IV. | V. |
|---|---|---|---|---|
| DICOTS - LAURACEAE | | | | |
| *Cassytha filiformis* L. Agasi; Magagas | V | P | Nd | U |
| DICOTS - LEGUMINOSAE-CAESALPINIACEAE | | | | |
| *Delonix regia* (Bojer) Raf. | T | T | Nd | U |
| DICOTS - LEGUMINOSAE-FABACEAE | | | | |
| *Abrus precatorius* L. Kolales halomtano; Coral bean | V | T | Nd | U |
| *Alysicarpus vaginalis* (L.) DC. | H | T | Nt/N | U |
| *Crotalaria pallida* Ait. Pale Rattlebox | H | T | Nt/N | U |
| *Desmodium triflorum* (L.) Dc. | H | T | Nt/N | U |
| *Indigofera suffruticosa* Mill. | S | T | Nd | U/C |
| *Mucuna gigantea* (Willd.) DC. Bayogo dikike; Gayetan | V | T | Nd | U/C |
| *Sesbania cannabina* (Retz.) Pers. | H | T | Nt/N | R |
| DICOTS - LEGUMINOSAE-MIMOSACEAE | | | | |
| *Albizia lebbeck* (L.) Benth. Trongkon-mames; Mamis; Woman's tongue | T | T | Nt/N | U |
| *Desmanthus virgatus* (L.) Willd. | S | T | Nt/N | U |
| *Leucaena leucocephala* (Lam.) de Wit Tangantangan | T | T | Nt/N | A |
| *Mimosa pudica* L. Sleeping Grass; Sensitive plant | V | T | Nt/N | C |

TABLE 1 continued

| I. | II. | III. | IV. | V. |
|---|---|---|---|---|
| DICOTS - LEGUMINOSAE-MIMOSACEAE (con't) | | | | |
| *Pithecellobium dulce* (Roxb.) Benth. Kamachile | T | T | Nt/N | C |
| DICOTS - LYTHRACEAE | | | | |
| *Pemphis acidula* Forst. Nigas | S | T | Nd | U |
| DICOTS - MALVACEAE | | | | |
| *Hibiscus tiliaceus* L. Pago; Sea-hibiscus | T | T | Nd | A |
| *Malvastrum coromandelianum* (L.) Garcke | H | T | Nt/N | U |
| *Sida rhombifolia* L. var. *rhombifolia* Escobilla dalili; Dalili apaka | H | T | Nt/N | U |
| *Thespesia populnea* (L.) Sol ex Correa Banalo; Kilulu; Kuluk | S | T | Nd | C/A |
| DICOTS - MORACEAE | | | | |
| *Ficus prolixa* var. *subcordata* Corner Nunu; Taotaomona tree; Strangler Fig | T | T | Nd | R |
| *Ficus tinctoria* var *neo-ebudarum* (Summerh.) Fosb. | T | T | Nd | R |
| DICOTS - MYRTACEAE | | | | |
| *Eugenia palumbis* Merr. Agatelang | T | T | Nd | R |

TABLE 1 continued

| I. | II. | III. | IV. | V. |
|---|---|---|---|---|
| DICOTS - OLEACEAE | | | | |
| *Jasminum marianum* DC.<br>Banago | V | T | Nd | C |
| DICOTS - ONAGRACEAE | | | | |
| *Ludwigia octovalis* (Jacq.)Raven<br>Titimo | H | A | Nd | U |
| DICOTS - OXALIDACEAE | | | | |
| *Oxalis corniculata* L.<br>Apsom; Agsom; Yellow wood-sorrel | H | T | Nt/N | U/C |
| DICOTS - PASSIFLORACEAE | | | | |
| *Passiflora foetida* var. *hispida* (DC.)Killip<br>Love-in-a-mist | V | T | Nt/N | U |
| *Passiflora suberosa* L. | V | T | Nt/N | U |
| DICOTS - POLYGALACEAE | | | | |
| *Polygala paniculata* L. | H | T | Nt/N | U |
| DICOTS - POLYGONACEAE | | | | |
| *Portulaca oleracea* var. *granulato-stellulata* v. Poelln<br>Botdolagas, Donkulu | H | T | Nd | U/C |

TABLE 1 continued

| I. | II. | III. | IV. | V. |
|---|---|---|---|---|
| DICOTS - RHAMNACEAE | | | | |
| *Colubrina asiatica* (L.)Brongn.<br>Gasoso | S | T | Nd | U |
| DICOTS - RHIZOPHORACEAE | | | | |
| *Bruguiera gymnorhiza* (1.) Lam.<br>Mangle lahi | T | A | Nd | A |
| DICOTS - RUBIACEAE | | | | |
| *Aidia cochinchinensis* Lour.<br>Sumac | T | T | Nd | U |
| *Dentaria repens* J.R. & G. Forst.<br>Borduegas | H | T | Nt/N | U |
| *Hedyotis strigulosa* (Bartl. ex DC.)Fosb. | H | T | Nd | U |
| *Morinda citrifolia* L.<br>Lada | T | T | Nd | U |
| *Psychotria mariana* Bartl. ex. DC. | T | T | Nd | U |
| *Spermacoce assurgens* R. & P. | H | T | Nt/N | U |
| DICOTS - RUTACEAE | | | | |
| *Citrus* sp. | T | T | Nt | R |
| DICOTS - SAPINDACEAE | | | | |
| *Allophylus timorensis* (DC.) Bl.<br>Nger | S | T | Nd | R |
| *Dodonea viscosa* (L.)Jacq. | T | T | Nt/N | U/C |

TABLE 1 continued

| I. | II. | III. | IV. | V. |
|---|---|---|---|---|
| DICOTS - SAPOTACEAE | | | | |
| *Pouteria obovata* (R. Br.) Baehni | T | T | Nd | U |
| DICOTS - SCROPHULARIACEAE | | | | |
| *Bacopa monnieri* (L.)Wettst. | H | A | Nt/N | U |
| *Bacopa procumbens* (Mill.)Greenm. | H | T | Nt/N | U |
| DICOTS - SOLANACEAE | | | | |
| *Physalis* sp. | H | T | Nt | R |
| DICOTS - TILIACEAE | | | | |
| *Muntingia calabura* L. Manzanita; Panama Cherry | T | T | Nt/N | U |
| DICOTS - URTICACEAE | | | | |
| *Pilea microphylla* (L.)Liebm. | H | T | Nt/N | U |
| DICOTS - VERBENACEAE | | | | |
| *Lippia nodiflora* (L.) Rich. | H | T | Nt/N | U/C |
| *Premna obtusifolia* R. Br. Ahgao | T | T | Nd | U |
| *Stachytarpheta jamaicensis* (L.) Vahl | H | T | Nt/N | C |
| *Stachytarpheta urticifolia* Sims | H | T | Nt/N | U |

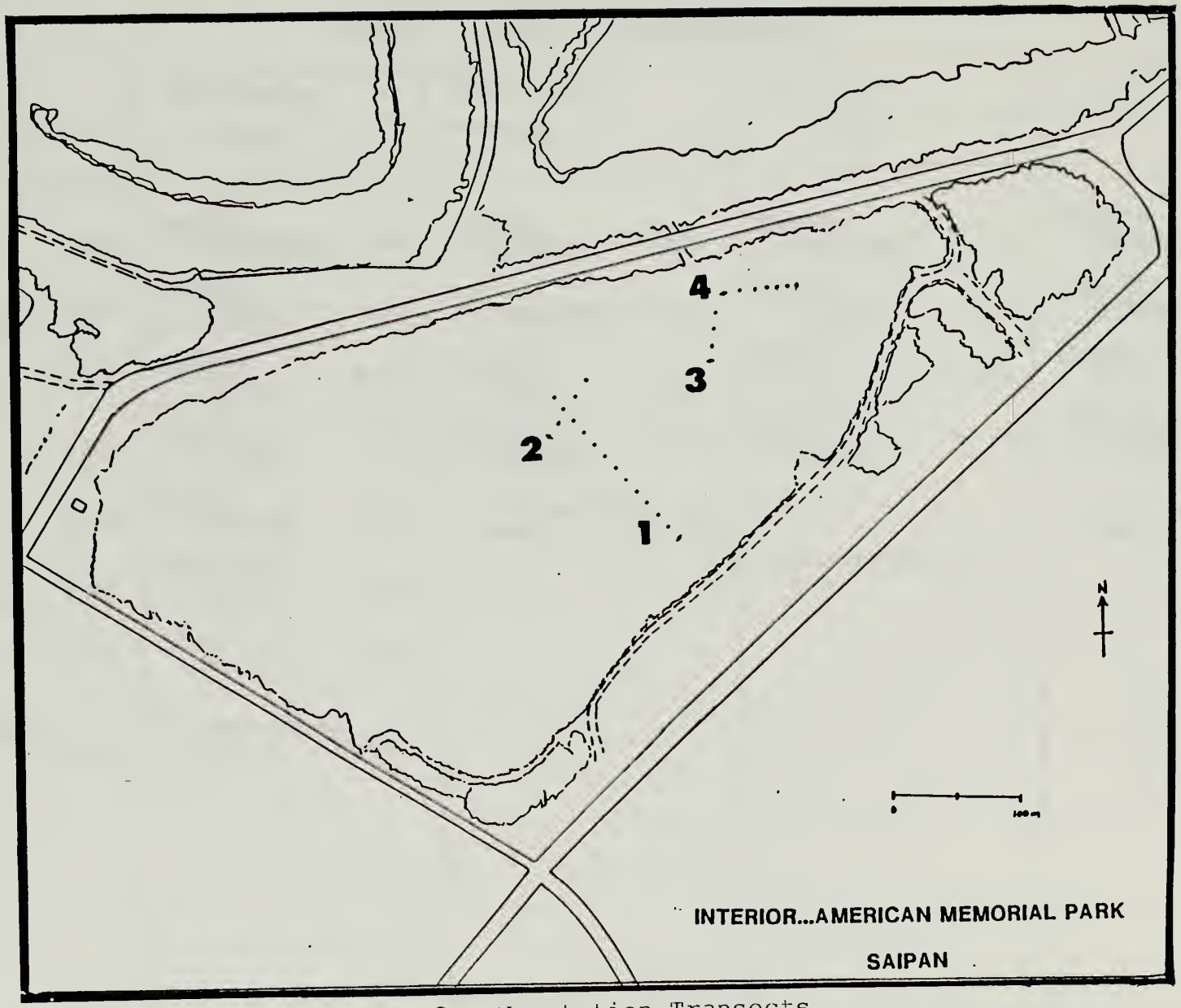


Figure 2. Vegetation Transects

TABLE 2. VEGETATION TRANSECTS

TRANSECT 1. SPECIES and IMPORTANCE VALUES

| BOTTON STRATUM < 1m | | LOWER STRATUM 1-3m | | UPPER STRATUM 3-10m | | TOP STRATUM > 10m | | ALL STRATA COMBINED | |
|---|---|---|---|---|---|---|---|---|---|
| Nephrolepis hirsutula | 0.645 | Leucaena leucocephala | 0.424 | Hibiscus tiliaceus | 0.901 | Leucaena leucocephala | 1.019 | Hibiscus tiliaceus | 1.546 |
| Leucaena leucocephala | 0.275 | Hibiscus tiliaceus | 0.383 | Leucaena leucocephala | 0.469 | Hibiscus tiliaceus | 0.391 | Leucaena leucocephala | 0.528 |
| Eupatorium odoratum | 0.223 | Ipomoea indica | 0.280 | Ipomoea indica | 0.240 | Ipomoea indica | 0.205 | Ipomoea indica | 0.238 |
| Ipomoea indica | 0.222 | Momordica charantia | 0.154 | Passiflora suberosa | 0.133 | Mucuna gigantea | 0. 139 | Nephrolepis hirsutula | 0.104 |
| Hibiscus tiliaceus | 0.168 | Ipomoea macrantha | 0.149 | 7 other species, each | <0.100 | | | 19 other species, each | <0.100 |
| Polypodium scolopendria | 0.139 | Eupatorium odoratum | 0.130 | | | 4 other species, each | <0.100 | | |
| Momordica charantia | 0.135 | Ficus tinctoria | 0.103 | | | | | | |
| 5 other species, each | <0.100 | 7 other species, each | <0.100 | | | | | | |

TABLE 2. Continued

TRANSECT 2. SPECIES AND IMPORTANCE VALUES

| BOTTOM STRATUM | LOWER STRATUM | UPPER STRATUM | TOP STRATUM | ALL STRATA COMBINED |
|---|---|---|---|---|
| <1m | 1 - 3m | 3 - 10m | >10m | |
| *Acrostichum aureum* 1.011 | *Ipomoea indica* 0.475 | *Leucaena leucocephala* 1.040 | *Casuarina equisetifolia* 1.618 | *Acrostichum aureum* 0.488 |
| *Mikania scandens* 0.503 | *Morinda citrifolia* 0.346 | *Jasminum marianum* 0.825 | *Jasminum marianum* 0.382 | *Leucaena leucocephala* 0.242 |
| *Ipomoea indica* 0.113 | *Eupatorium odoratum* 0.247 | *Ipomoea macrantha* 0.136 | No other species. | *Mikania scandens* 0.242 |
| *Ipomoea macrantha* 0.111 | *Mucuna gigantea* 0.228 | No other species. | | *Jasminum marianum* 0.231 |
| *Polypodium scolopendria* 0.111 | *Ipomoea macrantha* 0.217 | | | *Casuarina equisetifolia* 0.160 |
| 2 other species, each <0.100 | *Hibiscus tiliaceus* 0.189 | | | *Ipomoea indica* 0.159 |
| | *Leucaena leucocephala* 0.169 | | | *Ipomoea macrantha* 0.129 |
| | *Jasminum marianum* 0.130 | | | *Eupatorium odoratum* 0.101 |
| | No other species. | | | 5 other species, each <0.100 |

TABLE 2. Continued TRANSECT 3. SPECIES AND IMPORTANCE VALUES

| BOTTOM STRATUM <1m | | LOWER STRATUM 1 - 3m | | UPPER STRATUM 3 - 10m | | TOP STRATUM >10m | | ALL STRATA COMBINED | |
|---|---|---|---|---|---|---|---|---|---|
| Acrostichum aureum | 0.665 | Pandanus dubius | 0.579 | Hernandia sonora | 0.642 | Thespesia populnea | 0.746 | Hernandia sonora | 0.502 |
| Polypodium scolopendria | 0.381 | Hernandia sonora | 0.324 | Pandanus dubius | 0.576 | Mikania scandens | 0.626 | Pandanus dubius | 0.324 |
| Hernandia sonora | 0.276 | Polypodium scolopendria | 0.274 | Morinda citrifolia | 0.190 | Hernandia sonora | 0.621 | Thespesia populnea | 0.269 |
| Mikania scandens | 0.231 | Ficus tinctoria | 0.230 | Mucuna gigantea | 0.141 | Pithecellobium dulce | 0.228 | Polypodium scolopendria | 0.135 |
| Eupatorium odoratum | 0.173 | Leucaena leucocephala | 0.218 | Melanolepis multiglandulosa | 0.115 | Pandanus dubius | 0.217 | Acrostichum aureum | 0.130 |
| Thelypteris opulenta | 0.127 | Eupatorium odoratum | 0.106 | 4 other species, each | <0.100 | 1 other species | <0.100 | Mucuna gigantea | 0.104 |
| 2 other species, each | <0.100 | 3 other species, each | <0.100 | | | | | 12 other species, each | <0.100 |

TABLE 2. Continued

TRANSECT 4. SPECIES and IMPORTANCE VALUES

| BOTTOM STRATUM <1m | | LOWER STRATUM 1-3m | | UPPER STRATUM 3-10m | | TOP STRATUM >10m | | ALL STRATA COMBINED | |
|---|---|---|---|---|---|---|---|---|---|
| Acrostichum aureum | 0.664 | Pandanus dubius | 0.734 | Pandanus dubius | 1.135 | Casuarina equisetifolia | 1.558 | Bruguiera gymnorrhiza | 0.830 |
| Hymenocallis littoralis | 0.491 | Hibiscus tiliaceus | 0.367 | Hibiscus tiliaceus | 0.229 | Hernandia sonora | 0.183 | Pandanus dubius | 0.498 |
| Nephrolepis hirsutula | 0.202 | Bruguiera gymnorrhiza | 0.216 | Hernandia sonora | 0.221 | Bruguiera gymnorrhiza | 0.174 | Casuarina equisetifolia | 0.314 |
| Bruguiera gymnorrhiza | 0.140 | Hernandia sonora | 0.132 | Bruguiera gymnorrhiza | 0.115 | 1 other species, <0.100 | | Acrostichum aureum | 0.181 |
| Pandanus dubius | 0.112 | Passiflora suberosa | 0.126 | 4 other species, each <0.100 | | | | Hibiscus tiliaceus | 0.147 |
| Polypodium scolopendria | 0.107 | Phyllanthus mariahus | 0.126 | | | | | Hymenocallis littoralis | 0.137 |
| Eupatorium odoratum | 0.101 | 4 other species, each <0.100 | | | | | | Hernandia sonora | 0.125 |
| 2 other species, each <0.100 | | | | | | | | 12 other species, each <0.125 | |

Vegetation Map. The vegetation map (Fig. 3) was constructed from an aerial photograph of the area taken by the U. S. Geological Survey in 1987. The vegetation units were demarcated in the aerial photograph and ground proofed. The vegetation unit identification follows that of Jacobi (1988).

Photo Essay. Appendix 2 describes the uses and abuses of the park at present (January 1989).

## THE STUDY AREA

Saipan is the largest island, and also the capital, of the Commonwealth of the Northern Mariana Islands. It is located at 15° 12'N latitude and 145° 37'E longitude. It is approximately 13 miles (21 km) long and averages 4 miles (6 km) in width, occupying 46.6 square miles. It lies within the humid tropics with an average relative humidity of 83%. The average wind velocity is 10.5 mph (17 kph); The NE and ENE trade winds are persistent during the January to May dry season whereas winds from various directions are less strong, and sporadic, during the rainy season (Tenorio and Associates 1979).

Saipan is a part of the Mariana Island arc system, and had its beginning about 42 million years ago in an area to the west called the Palau-Kyushu Ridge. Between that time and the present the island has undergone eastward movement, volcanic activity, uplift and subsidence with attendant reef formation, and erosion by wind, rain and movements of the sea. Contained within the rock formations are three volcanic cores, numerous fault lines, and layered volcanic and calcareous rocks (Cloud et al 1956).

The west coast of Saipan south from Magpi benches consists of an almost continuous lime sand beach backed by a few low limestone ridges and underlain by Tagpochau limestone formed in the early Miocene. The lowest bench and the entire western coastal plain are constructional in origin. The Matansa (Massacre) Fault which runs NNE by SSW and is downfaulted to the west (Cloud et al 1956) passes along the eastern edge of the park.

The Park is located on the northern boundary of the township of Garapan on the west coast of the island of Saipan (Fig. 4). The Park consists of the terrestrial environment only. Coastal waters and islets are not within the Park's jurisdiction. It is bounded by Garapan and Tanapag Lagoons from approximately 100m south of Puntan Muchot to Puntan Flores on the north and west, Beach and Middle Roads on the east, and the road to the Hyatt Hotel on the south (Fig. 1). The area is part of a level elevated reef flat and all of it is less than three meters above

Key to vegetation map symbols

| Symbol | Description |
|---|---|
| c-M:Ll(v) | closed mesic tangantangan scrub with vines. |
| c-M:ns | closed mesic native shrubs. |
| c-W:Bg-nt | closed wet mixed forest with mangroves. |
| c-W:Ht | closed hibiscus forest. |
| o-M:Ce(v-g) | open mesic ironwood forest with grassland and morning glory vine understory. |
| o-M:(g) | open dry area with mixed grasses (mown areas). |
| o-M:(v-g) | open mesic grassland with morning glory vines. |
| o-W:(Aa) | open wetland with Acrostichum aureum. |
| o-W:Ce,nt(Aa) | open wet ironwood forest with other native trees and an understory of Acrostichum aureum. |
| o-W:(h) | open wetland with native herbs. |
| p | planted ornamentals. |

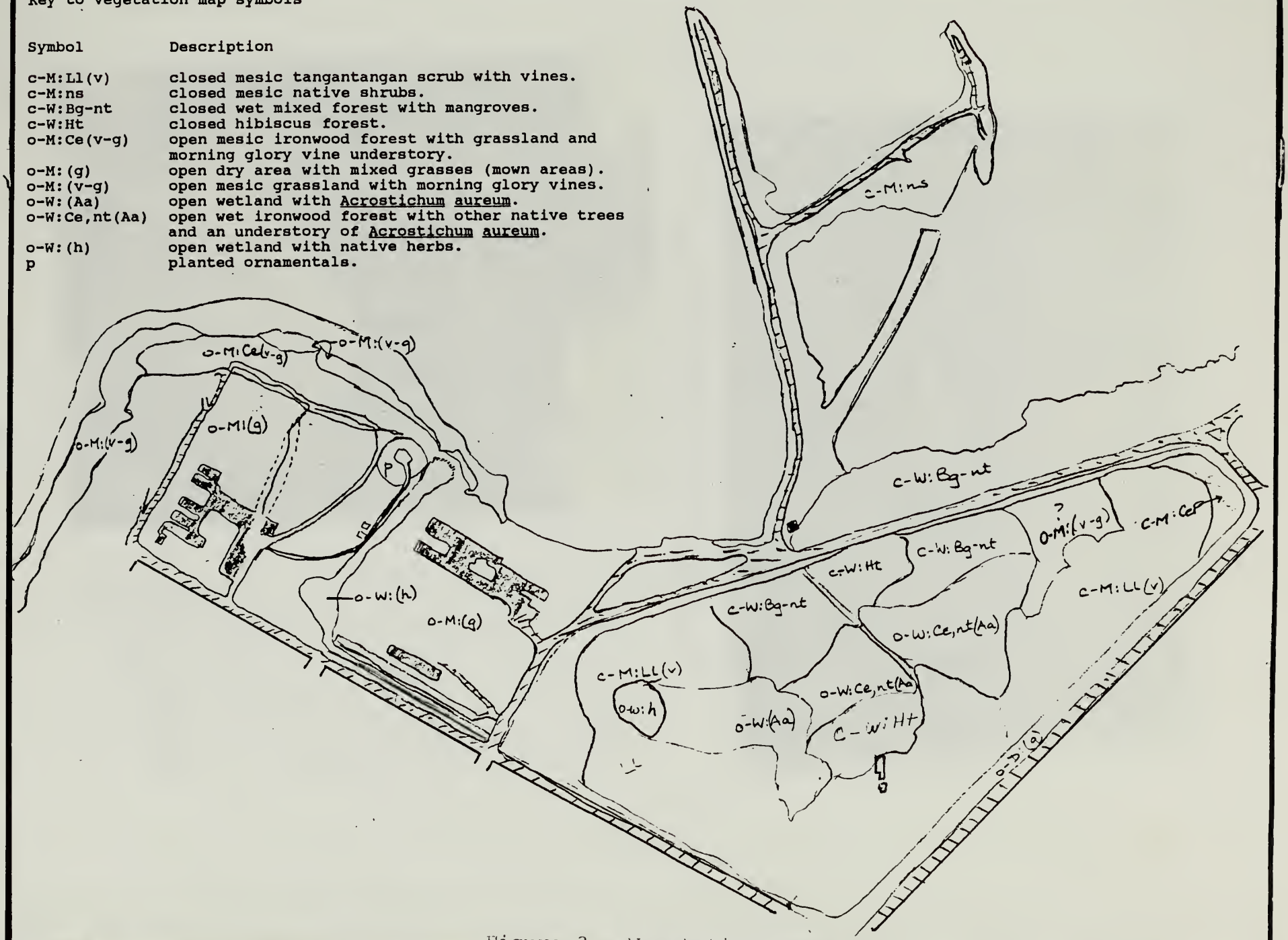


Figure 3. Vegetation Map

Figure 4. Garapan and the barrier reef with Managaha Island from Mt. Topochau.

Figure 5. Dumping area.

sea-level. The whole area has been altered by bulldozing and the construction of roads and buildings. The wetland area, except that which lies between Beach Road and Tanapag Lagoon, is also modified so that there are two containment areas one of which is undrained, the other slightly to its south is associated with a small culvert under Beach Road. An exercise track circled this entire segment of the wetland study site in 1986, but it has been abandoned and overgrown with weeds. The two ponding areas are separated by a dirt road raised about one and one half meters above the surrounding terrain. It is now impassable because of downed vegetation, and bears along its southern margin a large diameter pipe, possibly an old sewage pipe.

The north-western edge of the park abutting Tanapag Lagoon consists of artificial coral-fill jetties. The jetties are vegetated with a considerable amount of scrub on either side of a jeep road. The coastal margin of the Park along Tanapag Lagoon is a continuation of the interior mangrove swamp and coastal forest. It contains several dump-sites which are not only unsightly and unhygenic but also disrupt revegetation of the mangrove swamp (Figs. 5, 6, and 7).

## RESULTS AND DISCUSSION

There are 128 species of vascular plants in the Park (Table 1), thirteen (10%) of which are ferns and fern allies. The remainder are flowering plants; there are no conifers present. Fifty-six species (44%) are indigenous, none endemic to the Marianas. Seventy-two species (56%) are introduced, 67 (78%) of which are naturalized.

There are no U. S. Federal endangered species present. There is no list of endangered plants for the Commonwealth. None of the plants is rare by any consideration. However, the orchid Zeuxine fritzii (which was named for a German governor of Saipan) occurs around the swamp edge in the park and has only been found in one other place in recent times, though perhaps is more common and merely overlooked.

None of the plants present is considered noxious.

Vegetation types within the natural area include mangrove swamps, marshes, strand, coastal scrub and weedy scrub.

Mangrove swamps are wetlands dominated by woody mangrove vegetation, in this case, Bruguiera gymnorhiza

Figure 6. Trash, and smoke from the dump.

Figure 7. Trash, smoke from the dump and eroding jetty.

(Fig. 8). It is the dominant and only Pacific mangrove species in the Park (and Saipan) although more species are common to mangrove swamps further south. Hibiscus tiliaceus is always an edge species of almost every ecosystem in the Marianas though it is more abundant around wetland areas. Its abundance results from its ability to take root anywhere along the stem. Therefore, when the tree overextends and falls or when strong winds, such as typhoons, knock it down the tree is not killed, but instead produces a number of new trunks. In a wetland more moisture is available to support these new shoots. Acrostichum aureum is a typical swamp fern. It tolerates a moderate amount of salinity and thus tends to be a feature of mangrove swamps in the Marianas and elsewhere. Casuarina equisetifolia, though present in the swamp, is typically confined to sandy areas above standing water.

A small marsh vegetated with Paspalum distichum and edged by Scirpus littoralis and Acrostichum aureum (Figs. 9 and 10) lies at the southwest portion of the interior. Another grassy area along the north and northwest part of the interior is not a marsh, but does get appreciable moisture; the grasses are Pennisetum purpureum and Panicum maximum, which are large but are not wetland species.

Many of the other species, including Hernandia sonora, Thespesia populnea, Jasminum marianum, Pandanus dubius and the herbs Hymenocallis littoralis, Ipomoea macrantha and Mucuna gigantea are typical strand species as well. The presence of these strand species in the swamp is simply the result of proximity to the shoreline and the sandy substrates which predominate within the study area because of bulldozing.

There are a number of weed species in the area which indicate that the area has been and is still disturbed. Leucaena leucoecephala, a dominant woody weed and an important soil stabilizer, has declined significantly now that the psyllid, Heteropsylla cubana, has become established. The vines such as Mikania scandens, Ipomoea indica and Momordica charantia tend to climb and provide a dense shade (Figs. 11 and 12); now that there is dead tangantangan, this will provide suitable support which will have to be accepted until other shading tree species invade the area.

The coastal scrub is a combination of species which are early colonists, and those which will be later climax vegetation. The jetties where this vegetation type occurs are dominated by brushy plants such as Eupatorium odoratum (Fig. 13), Pluchea indica, Pluchea symphitifolia,

Figure 8. Bruguiera gymnorhiza. Only Pacific mangrove species on Saipan.

Figure 9 Scirpus littoralis in small marsh.

Figure 10. Paspalum distichum, and Acrostichum aureum. Casuarina in the background.

Figure 11. Ipomoea indica growing on Leucaena leucocephala.

Figure 12. Mikania scandens and Ipomoea indica growing on tangantangan.

Figure 13. Eupatorium odoratum.

Tournefortia argentia, Scaevola sericea, Indigofera suffruticosa, Desmanthus virgatus, Jasminum marianum and Colubrina asiatica. There is also an impressive stand of Dodonaea viscosa in a place quite unusual for this species. However, it is extending itself and appears to be a successful colonizer although the storms may be detrimental to its continued survival in the area.

Several of the open areas are being taken over by templegrass, Zoysia matrella (Fig. 14). This species stabilizes the sand yet it is tolerant of such an exposed salty habitat. It should be encouraged and planted in the picnic areas.

Weedy scrubland vegetation occurs on scraped limestone over which there is a veneer of "soil." It is dominated by a variety of grasses, the sedge Fimbristylis cymosa (nutgrass) and various herbs such as Desmodium spp., Polygala paniculata, and Heliotropium procumbens. This is a highly artificial man-induced environment.

The Park has one of the only three mangrove sites on Saipan; The other two are at Salt Spring, also called Starch Factory Spring / Sadog Tasi, and along the western edge of Hagoi Susupe (Lake Susupe) where the Japanese-built canal brought in sea water. Mangroves are important land holding systems that buffer the effects of storms from the sea and hold erosion products moving off the land. Thus, they actually increase the size of areas in which they are found. Secondly, they are important nurseries of the young of many marine fishes and provide a sheltered, nutrient rich environment for species such as edible crabs and birdlife in general. As with all wetlands man should enroach with great caution. Any further disturbance to the area is potentially disastrous.

Although the area has obviously been a dump and a dumping site and has had much modification by bulldozing, it nevertheless has a long history of being a wetland and is so indicated on old maps and early references. There are many large structural units within the area. Decisions regarding the removal of smaller structures and concrete foundations will have to be evaluated in the light of the damage that might occur to the system. There are some concrete bunkers that could be left in situ. There are some metal structures that are deteriorating rapidly. If the Park wants to preserve them they will have to be protected in the very near future.

The old roadway could be cleaned up and made into a short nature trail for schools and visitors. A short transect aligned along the axis of transect 2 would provide a good example of wetland communities. At least

Figure 14. Temple grass on the jetty.

Figure 15. Trash from the municipal dump.

four families of the yellow honeyeater and at least an equal number of the cardinal honeyeaters were seen. Other birds including the white-faced dove and rufous-fronted fantail use the area and were readily observable; near sunset over 100 white-eyes flew in and settled down.

Transect 4 area has large Bruguiera, Casuarina and Acrostichum (Fig.2; Table 1). On the ground there are orchid species and a variety of species which would be expected in a climax forest. The diversity of species in this area makes it a particularly valuable area.

Botanically, the park comprises areas of weedy shrubs, strand and mangrove species. The jetty areas are still in a successional stage and have yet to develop into a mature climax ecosystem.

The mangrove swamp should not be allowed to dry out. If the proposed drainage canal results in loss of water from the system then mitigation must be planned to ensure that the swamp remains a swamp. The swamp is probably a balanced ecosystem of salt and fresh water. If the proposed canal is going to upset that balance then some mitigation must be planned. A prominent fault of the west coast of Saipan, the Matansas (Massacre) Fault occurs along the west coastal plain. Its exact location relative to the swamp and the proposed drainage cannal should be ascertained because of the impact of the fault on drainage patterns. It is important to understand that the canal will probably interrupt the sheet water flow that is an important source of fresh water to the swamp.

## RECOMMENDATIONS

Stop the dumping of trash along the coastal margin of Tanapag Lagoon. This will allow the mangrove to serve as a buffer between the sea and the main road preventing storm damage to the road and the rest of the park.

Negotiate the closure or proper management of the dump on Puntan Flores. Not only is the garbage which blows into the park unsightly (Fig. 15) and probably unhygenic; it also is an impediment to the establishment of many plants. The smoke is thoroughly obnoxious (Fig. 16). The value of the recreational areas developed on the jetties is being inpaired.

The Park should consider the possibility of planting Calophyllum inophyllum along the jetty area, especially in areas where it is wide enough to make picnic areas. This tree will tolerate salt water and spray and is also a common strand inhabitant in most of the Pacific. This

Figure 16. Smoke from the dump.

Figure 17. Harvested turf.

tree species will provide good shade for the picnickers. The root system will stabilize the shoreline yet the trees are very resistant to high winds.

Zoysia matrella should be transplanted from the areas it now occupies to other picnic areas. It is tolerant of trampling and will serve to stabilize the substratum. It is best transplanted by removing strips from healthy colonies and planting firmly in the desired area during the rainy season. The Park staff sould do everything they can to discourage local residents from their current practice of removing segments of the turf for their own use (Fig. 17).

Encouraging the further establishment of Casuarina equisetifolia along the jetties will also help to stabilize the substratum, but more active intervention will be required to shore up the jetties which are now in a precarious state (Fig. 14).

The development of roads on the ocean side of Beach Road should be discouraged. These roads can be a focus for storm activity which will be concentrated through these gaps and damage the road. Fishing and other activities in the area are acceptable as long as they not result in opening the coastal forest.

ACKNOWLEDGMENTS

The assistance of the park staff is appreciated.

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# APPENDIXES

## APPENDIX 1

## DATA USED TO CALCULATE IMPORTANCE VALUES

## APPENDIX 2

## PHOTO ESSAY

APPENDIX 1. DATA USED TO CALCULATE IMPORTANCE VALUES

**Data Sheet 3B.3.** *Class Summary of Data from Line-Intercept Plant Sampling*

Date 7 Aug. 1986 Observers

Habitat and stratum

Locality Amer. Mem. Park - Transect #1 - Totals of all 4 strata

Total transect length (*L*) 600 m

Total number of transect intervals 120

| Species (i) | Number of individuals ($n_i$) | Linear density index ($ID_i$) | Relative density ($RD_i$) | Present in how many transect intervals? ($f_i$)* | Frequency ($f_i$) | Relative frequency ($Rf_i$) | Intercept length ($l_i$)* | Linear coverage index ($IC_i$) | Relative coverage ($RC_i$) | Importance value ($IV_i$) |
|---|---|---|---|---|---|---|---|---|---|---|
| Hibiscus tiliaceus | | | | 39 | 0.325 | 0.209 | 137.6m | 0.229 | 0.337 | 1.546 |
| Leucaena leucocephala | | | | 42 | 0.350 | 0.225 | 123.7m | 0.206 | 0.303 | 0.528 |
| Ipomoea indica | | | | 27 | 0.225 | 0.145 | 38.1m | 0.064 | 0.093 | 0.238 |
| Pouteria obovata | | | | 3 | 0.025 | 0.016 | 2.6m | 0.004 | 0.006 | 0.022 |
| Polyscias pulchra | | | | 5 | 0.042 | 0.027 | 7.5m | 0.013 | 0.018 | 0.045 |
| Momordica charantia | | | | 12 | 0.100 | 0.064 | 9.9m | 0.017 | 0.024 | 0.088 |
| Acalypha indica | | | | 1 | 0.008 | 0.005 | 0.2m | 0.0003 | 0.001 | 0.006 |
| Eupatorium odoratum | | | | 8 | 0.067 | 0.043 | 10.4m | 0.017 | 0.026 | 0.069 |
| Carica papaya | | | | 1 | 0.008 | 0.005 | 1.0m | 0.002 | 0.003 | 0.008 |
| Passiflora subpeltata | | | | 7 | 0.058 | 0.037 | 11.0m | 0.018 | 0.027 | 0.064 |
| Desmanthus virgatus | | | | 1 | 0.008 | 0.005 | 0.4m | 0.001 | 0.001 | 0.006 |
| Jasminum mariannum | | | | 7 | 0.058 | 0.037 | 11.2m | 0.019 | 0.028 | 0.065 |
| Ficus tinctoria | | | | 2 | 0.017 | 0.011 | 4.5m | 0.008 | 0.011 | 0.022 |

* Data collected in these columns are from the totals on data sheet 3B.2. Data in the other columns are calculated from them.

8 **Data Sheet 3B.3.** *Class Summary of Data from Line-Intercept Plant Sampling*

Date 7 Aug. 1986 Observers

Habitat and stratum

Locality Amer. Mem. Park – Transect #1 Bottom stratum

Total transect length (*L*) 150 m

Total number of transect intervals 30

| Species (*i*) | Number of individuals ($n_i$) | Linear density index ($ID_i$) | Relative density ($RD_i$) | Present in how many transect intervals? ($f_i$)* | Frequency ($f_i$) | Relative frequency ($Rf_i$) | Intercept length ($l_i$)* | Linear coverage index ($IC_i$) | Relative coverage ($RC_i$) | Importance value ($IV_i$) |
|---|---|---|---|---|---|---|---|---|---|---|
| H. thiaicus | | | | 4 | 0.133 | 0.103 | 3.7 m | 0.025 | 0.065 | 0.168 |
| L. leucocephala | | | | 4 | 0.133 | 0.103 | 9.8 m | 0.065 | 0.172 | 0.275 |
| I. indica | | | | 5 | 0.167 | 0.129 | 5.3 m | 0.035 | 0.093 | 0.222 |
| Pouteria | | | | 1 | 0.033 | 0.025 | 1.2 m | 0.008 | 0.021 | 0.046 |
| Momordica | | | | 4 | 0.133 | 0.103 | 1.8 m | 0.012 | 0.032 | 0.135 |
| Poly. scalop | | | | 3 | 0.100 | 0.077 | 3.5 m | 0.023 | 0.062 | 0.139 |
| Acalypha | | | | 1 | 0.033 | 0.025 | 0.2 m | 0.001 | 0.004 | 0.029 |
| Eupatorium | | | | 6 | 0.200 | 0.154 | 3.9 m | 0.026 | 0.069 | 0.223 |
| Passiflora | | | | 1 | 0.033 | 0.025 | 0.3 m | 0.002 | 0.005 | 0.030 |
| Stachocardia | | | | 1 | 0.033 | 0.025 | 0.2 m | 0.001 | 0.004 | 0.029 |
| Mikania | | | | 1 | 0.033 | 0.025 | 2 m | 0.013 | 0.035 | 0.060 |
| Nephrolepis | | | | 8 | 0.267 | 0.206 | 25 m | 0.167 | 0.439 | 0.645 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Totals | $\Sigma n =$ | $\Sigma ID =$ | $\Sigma RD = 1.0$ | | $\Sigma f = 1.298$ | $\Sigma Rf = 1.0$ | $\Sigma l = 56.9$ | $\Sigma IC = 0.603$ | $\Sigma RC = 1.0$ | |

* Data collected in these columns are from the totals on data sheet 3B.2. Data in the other columns are calculated from them.

8 **Data Sheet 3B.3.** *Class Summary of Data from Line-Intercept Plant Sampling*

Date 7 August 1984 Observers

Habitat and stratum

Locality Amer. Mem. Park – Transect #1 – Lower stratum

Total transect length ($L$) 150 m

Total number of transect intervals 30

| Species ($i$) | Number of individuals ($n_i$) | Linear density index ($ID_i$) | Relative density ($RD_i$) | Present in how many transect intervals? ($f_i$)* | Frequency ($f_i$) | Relative frequency ($Rf_i$) | Intercept length ($l_i$)* | Linear coverage index ($IC_i$) | Relative coverage ($RC_i$) | Importance value ($IV_i$) |
|---|---|---|---|---|---|---|---|---|---|---|
| H. tiliaceus | | | | 7 | 0.233 | 0.140 | 17.5m | 0.117 | 0.243 | 0.383 |
| Leucaena | | | | 8 | 0.267 | 0.160 | 19.0 m | 0.127 | 0.264 | 0.424 |
| Ipomoea | | | | 9 | 0.300 | 0.180 | 7.2 m | 0.048 | 0.100 | 0.280 |
| Pouteria | | | | 2 | 0.067 | 0.040 | 1.4 m | 0.009 | 0.020 | 0.060 |
| Polypodium | | | | 2 | 0.067 | 0.040 | 4.0 m | 0.027 | 0.056 | 0.096 |
| Momordica | | | | 5 | 0.167 | 0.100 | 3.9 m | 0.026 | 0.054 | 0.154 |
| Eupatorium | | | | 2 | 0.067 | 0.040 | 6.5 m | 0.043 | 0.090 | 0.130 |
| Passiflora | | | | 1 | 0.033 | 0.020 | 0.3 m | 0.002 | 0.004 | 0.024 |
| Desmanthus | | | | 1 | 0.033 | 0.020 | 0.4 m | 0.003 | 0.006 | 0.026 |
| Jasminum | | | | 2 | 0.067 | 0.040 | 3.0 m | 0.020 | 0.042 | 0.082 |
| Ficus | | | | 2 | 0.067 | 0.040 | 4.5 m | 0.030 | 0.063 | 0.103 |
| Psychotria | | | | 2 | 0.067 | 0.040 | 1.7 m | 0.011 | 0.024 | 0.064 |
| Melanolepis | | | | 1 | 0.033 | 0.020 | 0.4 m | 0.003 | 0.006 | 0.026 |
| Ipomoea | | | | 6 | 0.200 | 0.120 | 2.1 m | 0.014 | 0.029 | 0.149 |
| | | | | | | | | | | |
| Totals | $\Sigma n =$ | $\Sigma ID =$ | $\Sigma RD = 1.0$ | | $\Sigma f = 1.668$ | $\Sigma Rf = 1.0$ | $\Sigma l = 71.9$ | $\Sigma IC = 0.48$ | $\Sigma RC = 1.0$ | |

* Data collected in these columns are from the totals on data sheet 3B.2. Data in the other columns are calculated from them.

8 **Data Sheet 3B.3.** *Class Summary of Data from Line-Intercept Plant Sampling*

Date 7 August 1986 Observers _____

Habitat and stratum _____

Locality Amer. Mem. Park - Transect #1 - Upper stratum

Total transect length (*L*) 150 m

Total number of transect intervals 30

| Species (*i*) | Number of individuals ($n_i$) | Linear density index ($ID_i$) | Relative density ($RD_i$) | Present in how many transect intervals? ($f_i$)* | Frequency ($f_i$) | Relative frequency ($Rf_i$) | Intercept length ($l_i$)* | Linear coverage index ($IC_i$) | Relative coverage ($RC_i$) | Importance value ($IV_i$) |
|---|---|---|---|---|---|---|---|---|---|---|
| Hibiscus | | | | 23 | 0.767 | 0.354 | 92.9m | 0.619 | 0.547 | 0.901 |
| leucaena | | | | 15 | 0.500 | 0.231 | 40.4m | 0.269 | 0.238 | 0.469 |
| Epom. indica | | | | 10 | 0.333. | 0.154 | 14.6m | 0.097 | 0.086 | 0.240 |
| Momordica | | | | 2 | 0.067 | 0.031 | 0.5m | 0.003 | 0.003 | 0.034 |
| Canca | | | | 1 | 0.033 | 0.015 | 1.0m | 0.007 | 0.006 | 0.021 |
| Passiflora | | | | 4 | 0.133 | 0.061 | 6.4m | 0.043 | 0.038 | 0.133 |
| Jasminum | | | | 2 | 0.067 | 0.031 | 3.0m | 0.020 | 0.018 | 0.049 |
| Mucuna | | | | 4 | 0.133 | 0.061 | 4.5m | 0.030 | 0.027 | 0.088 |
| Mikania | | | | 2 | 0.067 | 0.031 | 4.0m | 0.027 | 0.024 | 0.055 |
| Hamada | | | | 1 | 0.033 | 0.015 | 2.0m | 0.013 | 0.012 | 0.027 |
| Pithecellob | | | | 1 | 0.033 | 0.015 | 0.4m | 0.003 | 0.002 | 0.017 |
| Totals | $\Sigma n$ = | $\Sigma ID$ = | $\Sigma RD = 1.0$ | | $\Sigma f = 2.166$ | $\Sigma Rf = 1.0$ | $\Sigma l = 169.7$ | $\Sigma IC = 1.131$ | $\Sigma RC = 1.0$ | |

* Data collected in these columns are from the totals on data sheet 3B.2. Data in the other columns are calculated from them.

8 **Data Sheet 3B.3.** *Class Summary of Data from Line-Intercept Plant Sampling*

Date 7 Aug. 1984 Observers

Habitat and stratum

Locality Amer. Mem. Park – Transect #1 Top stratum

Total transect length (*L*) 150 m

Total number of transect intervals 30

| Species (*i*) | Number of individuals ($n_i$) | Linear density index ($ID_i$) | Relative density ($RD_i$) | Present in how many transect intervals? ($f_i$)* | Frequency ($f_i$) | Relative frequency ($Rf_i$) | Intercept length ($l_i$)* | Linear coverage index ($IC_i$) | Relative coverage ($RC_i$) | Importance value ($IV_i$) |
|---|---|---|---|---|---|---|---|---|---|---|
| Hibiscus | | | | 5 | 0.167 | 0.167 | 23.5 m | 0157 | 0.224 | 0.391 |
| Leucaena | | | | 15 | 0.500 | 0.500 | 54.5 m | 0.363 | 0.519 | 1.019 |
| Ipom. indica | | | | 3 | 0.100 | 0.100 | 11.0 m | 0.073 | 0.105 | 0.205 |
| Momordica | | | | 1 | 0.033 | 0.033 | 4.5 m | 0.030 | 0.043 | 0.076 |
| Passiflora | | | | 1 | 0.033 | 0.033 | 4.0m | 0.027 | 0.038 | 0.071 |
| Stictocardia | | | | 1 | 0.033 | 0.033 | 3.0m | 0.020 | 0.029 | 0.062 |
| Mucuna | | | | 3 | 0.100 | 0.100 | 4.1 m | 0.027 | 0.039 | 0.139 |
| Pithecellobium | | | | 1 | 0.033 | 0.033 | 0.4m | 0.003 | 0.004 | 0.037 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Totals | $\Sigma n =$ | $\Sigma ID =$ | $\Sigma RD = 1.0$ | | $\Sigma f = 0.999$ | $\Sigma Rf = 1.0$ | $\Sigma l = 105$ | $\Sigma IC = 0.7$ | $\Sigma RC = 1.0$ | |

* Data collected in these columns are from the totals on data sheet 3B.2. Data in the other columns are calculated from them.

8 Data Sheet 3B.3. *Class Summary of Data from Line-Intercept Plant Sampling*

Date 7 August 1986 Observers

Habitat and stratum

Locality Amer Mem Park - Transect # 2 - total for all strata

Total transect length ($L$) 220 m

Total number of transect intervals 44

| Species ($i$) | Number of individuals ($n_i$) | Linear density index ($ID_i$) | Relative density ($RD_i$) | Present in how many transect intervals? ($f_i$)* | Frequency ($f_i$) | Relative frequency ($RF_i$) | Intercept length ($l_i$)* | Linear coverage index ($IC_i$) | Relative coverage ($RC_i$) | Importance value ($IV_i$) |
|---|---|---|---|---|---|---|---|---|---|---|
| Hybiscus tiliaceus | | | | 1 | 0.023 | 0.022 | 2.5 m | 0.011 | 0.020 | 0.042 |
| Acrostich. aureum | | | | 9 | 0.205 | 0.195 | 36 m | 0.164 | 0.293 | 0.488 |
| Casuarina equisetif. | | | | 4 | 0.091 | 0.087 | 9 m | 0.041 | 0.073 | 0.160 |
| Mikania scandens | | | | 5 | 0.114 | 0.109 | 16.3 m | 0.074 | 0.133 | 0.242 |
| Leucaena leucocephala | | | | 6 | 0.136 | 0.130 | 13.8 m | 0.063 | 0.112 | 0.242 |
| Ipomoea indica? | | | | 3 | 0.068 | 0.065 | 11.5 m | 0.052 | 0.094 | 0.159 |
| Polypod. scolopend. | | | | 2 | 0.046 | 0.044 | 0.9 m | 0.004 | 0.007 | 0.051 |
| Jasminum mo-ianum | | | | 5 | 0.114 | 0.109 | 15 m | 0.068 | 0.122 | 0.231 |
| Mucuna gigantea | | | | 1 | 0.023 | 0.022 | 3.5 m | 0.016 | 0.029 | 0.051 |
| Passif. suberosa | | | | 1 | 0.023 | 0.022 | 0.8 m | 0.004 | 0.007 | 0.029 |
| Morinda citrif. | | | | 2 | 0.046 | 0.044 | 4.2 m | 0.019 | 0.034 | 0.078 |
| Ipomoea maritima | | | | 5 | 0.114 | 0.109 | 2.4 m | 0.011 | 0.020 | 0.129 |

* Data collected in these columns are from the totals on data sheet 3B.2. Data in the other columns are calculated from them.

8 **Data Sheet 3B.3.** *Class Summary of Data from Line-Intercept Plant Sampling*

Date 7 Aug. 1986 Observers

Habitat and stratum

Locality Amer. Hem Park - Transect #2 - total for all strata

Total transect length ($L$) 220m

Total number of transect intervals 44

| Species ($i$) | Number of individuals ($n_i$) | Linear density index ($ID_i$) | Relative density ($RD_i$) | Present in how many transect intervals? ($f_i$)* | Frequency ($f_i$) | Relative frequency ($Rf_i$) | Intercept length ($l_i$)* | Linear coverage index ($IC_i$) | Relative coverage ($RC_i$) | Importance value ($IV_i$) |
|---|---|---|---|---|---|---|---|---|---|---|
| Chrysolaena odorata | | | | 2 | 0.046 | 0.044 | 7m | 0.032 | 0.057 | 0.101 |
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| | | | | | | | | | | |
| Totals | $\Sigma n =$ | $\Sigma ID =$ | $\Sigma RD = 1.0$ | | $\Sigma f = 1.049$ | $\Sigma Rf = 1.0$ | $\Sigma l = 122.9$ | $\Sigma IC = 0.559$ | $\Sigma RC = 1.0$ | |

* Data collected in these columns are from the totals on data sheet 3B.2. Data in the other columns are calculated from them.

* does not include $RD_i$

8 **Data Sheet 3B.3.** *Class Summary of Data from Line-Intercept Plant Sampling*

Date 7 Aug. 1986 Observers

Habitat and stratum

Locality Amer. Memorial Park - Transect #2 - bottom stratum

Total transect length ($L$) 55 m

Total number of transect intervals 11

| Species ($i$) | Number of individuals ($n_i$) | Linear density index ($ID_i$) | Relative density ($RD_i$) | Present in how many transect intervals? ($f_i$)* | Frequency ($f_i$) | Relative frequency ($Rf_i$) | Intercept length ($l_i$)* | Linear coverage index ($IC_i$) | Relative coverage ($RC_i$) | Importance value ($IV_i$) |
|---|---|---|---|---|---|---|---|---|---|---|
| Acrostichum aureum | | | | 9 | 0.818 | 0.431 | 36 m | 0.655 | 0.58 | 1.011 |
| Mikania scandens | | | | 5 | 0.455 | 0.240 | 16.3 m | 0.296 | 0.263 | 0.503 |
| Ipomoea indica? | | | | 1 | 0.091 | 0.048 | 4 m | 0.073 | 0.065 | 0.113 |
| Polypod. scolopendria | | | | 2 | 0.182 | 0.096 | 0.9 m | 0.016 | 0.015 | 0.111 |
| Passiflora suberosa | | | | 1 | 0.091 | 0.048 | 0.8 m | 0.015 | 0.013 | 0.061 |
| Ipomoea maritima? | | | | 2 | 0.182 | 0.096 | 0.9 m | 0.016 | 0.015 | 0.111 |
| Chromolaena Odorata | | | | 1 | 0.091 | 0.048 | 3 m | 0.055 | 0.049 | 0.097 |
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| | | | | | | | | | | |
| Totals | $\Sigma n =$ | $\Sigma ID =$ | $\Sigma RD = 1.0$ | | $\Sigma f = 1.900$ | $\Sigma Rf = 1.0$ | $\Sigma l = 61.9$ m | $\Sigma IC = 1.126$ | $\Sigma RC = 1.0$ | |

* Data collected in these columns are from the totals on data sheet 3B.2. Data in the other columns are calculated from them.

8 **Data Sheet 3B.3.** *Class Summary of Data from Line-Intercept Plant Sampling*

Date 7 August 1986 Observers _____

Habitat and stratum _____

Locality Amer Mem. Park - Transect #2 - lower stratum

Total transect length ($L$) 55 m

Total number of transect intervals 11

| Species ($i$) | Number of individuals ($n_i$) | Linear density index ($ID_i$) | Relative density ($RD_i$) | Present in how many transect intervals? ($f_i$)* | Frequency ($f_i$) | Relative frequency ($Rf_i$) | Intercept length ($l_i$)* | Linear coverage index ($IC_i$) | Relative coverage ($RC_i$) | Importance value ($IV_i$) |
|---|---|---|---|---|---|---|---|---|---|---|
| Hibiscus tiliaceus | | | | 1 | 0.091 | 0.091 | 2.5 m | 0.046 | 0.098 | 0.189 |
| Leucaena leucocephala | | | | 1 | 0.091 | 0.091 | 2 m | 0.036 | 0.078 | 0.169 |
| Ipomoea indica? | | | | 2 | 0.182 | 0.182 | 7.5 m | 0.136 | 0.293 | 0.475 |
| Jasminum sambac | | | | 1 | 0.091 | 0.091 | 1 m | 0.018 | 0.039 | 0.130 |
| Mucuna gigantea | | | | 1 | 0.091 | 0.091 | 3.5 m | 0.064 | 0.137 | 0.228 |
| Morinda citrifolia | | | | 2 | 0.182 | 0.182 | 4.2 m | 0.076 | 0.164 | 0.346 |
| Ipomoea macrantha? | | | | 2 | 0.182 | 0.182 | 0.9 m | 0.016 | 0.035 | 0.217 |
| Chromolaena odorata | | | | 1 | 0.091 | 0.091 | 4 m | 0.073 | 0.156 | 0.247 |
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| | | | | | | | | | | |
| Totals | $\Sigma n =$ | $\Sigma ID =$ | $\Sigma RD = 1.0$ | | $\Sigma f = 1.001$ | $\Sigma Rf = 1.0$ | $\Sigma l = 25.6$ m | $\Sigma IC = 0.465$ | $\Sigma RC = 1.0$ | |

* Data collected in these columns are from the totals on data sheet 3B.2. Data in the other columns are calculated from them.

8 **Data Sheet 3B.3.** *Class Summary of Data from Line-Intercept Plant Sampling*

Date 7 August 1986 Observers _____

Habitat and stratum _____

Locality Amer. Men. Park - Transect # 2 - upper stratum

Total transect length ($L$) 55 m

Total number of transect intervals 11

| Species ($i$) | Number of individuals ($n_i$) | Linear density index ($ID_i$) | Relative density ($RD_i$) | Present in how many transect intervals? ($f_i$)* | Frequency ($f_i$) | Relative frequency ($RF_i$) | Intercept length ($l_i$)* | Linear coverage index ($IC_i$) | Relative coverage ($RC_i$) | Importance value ($IV_i$) |
|---|---|---|---|---|---|---|---|---|---|---|
| Leucaena leucocph. | | | | 5 | 0.455 | 0.556 | 11.8 m | 0.215 | 0.484 | 1.04 |
| Jasmin. mauritianum | | | | 3 | 0.273 | 0.333 | 12 m | 0.218 | 0.492 | 0.825 |
| Ipomoea mauritiana | | | | 1 | 0.091 | 0.111 | 0.6 m | 0.011 | 0.025 | 0.136 |
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| Totals | $\Sigma n =$ | $\Sigma ID =$ | $\Sigma RD = 1.0$ | | $\Sigma f = 0.819$ | $\Sigma RF = 1.0$ | $\Sigma l = 24.4$ | $\Sigma IC = 0.444$ | $\Sigma RC = 1.0$ | |

* Data collected in these columns are from the totals on data sheet 3B.2. Data in the other columns are calculated from them.

8 **Data Sheet 3B.3.** *Class Summary of Data from Line-Intercept Plant Sampling*

Date 7 August 1986 Observers _____

Habitat and stratum _____

Locality Amer. Memor. Park - Transect #2 top stratum

Total transect length ($L$) 55m

Total number of transect intervals 11

| Species ($i$) | Number of individuals ($n_i$) | Linear density index ($ID_i$) | Relative density ($RD_i$) | Present in how many transect intervals? ($f_i$)* | Frequency ($f_i$) | Relative frequency ($Rf_i$) | Intercept length ($l_i$)* | Linear coverage index ($IC_i$) | Relative coverage ($RC_i$) | Importance value ($IV_i$) |
|---|---|---|---|---|---|---|---|---|---|---|
| Casuarina equisetifolia | | | | 4 | 0.364 | 0.800 | 9m | 0.164 | 0.818 | 1.618 |
| Tristaniopsis laurina | | | | 1 | 0.091 | 0.200 | 2m | 0.036 | 0.182 | 0.382 |
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| | | | | | | | | | | |
| Totals | $\Sigma n =$ | $\Sigma ID =$ | $\Sigma RD = 1.0$ | | $\Sigma f = 0.455$ | $\Sigma Rf = 1.0$ | $\Sigma l = 11$ m | $\Sigma IC = 0.2$ | $\Sigma RC = 1.0$ | |

* Data collected in these columns are from the totals on data sheet 3B.2. Data in the other columns are calculated from them.

8 **Data Sheet 3B.3.** *Class Summary of Data from Line-Intercept Plant Sampling*

Date 8 August 1984 Observers

Habitat and stratum

Locality Transect #3 Am. Mem Park 4 strata Totals for all strata

Total transect length ($L$) 200 m

Total number of transect intervals 40

| Species ($i$) | Number of individuals ($n_i$) | Linear density index ($ID_i$) | Relative density ($RD_i$) | Present in how many transect intervals? ($f_i$)* | Frequency ($f_i$) | Relative frequency ($Rf_i$) | Intercept length ($l_i$)* | Linear coverage index ($IC_i$) | Relative coverage ($RC_i$) | Importance value ($IV_i$) |
|---|---|---|---|---|---|---|---|---|---|---|
| Ficus tinctoria | | | | 2 | 0.050 | 0.033 | 3.5m | 0.018 | 0.026 | 0.059 |
| Hernandia sonora | | | | 12 | 0.300 | 0.197 | 40.5m | 0.203 | 0.305 | 0.502 |
| Leucaena leucocephala | | | | 2 | 0.050 | 0.033 | 1.1 m | 0.006 | 0.008 | 0.041 |
| Passiflora suberosa | | | | 1 | 0.025 | 0.016 | 0.1 m | 0.001 | 0.001 | 0.017 |
| Thelypt. opulenta | | | | 1 | 0.025 | 0.016 | 1.5m | 0.008 | 0.011 | 0.027 |
| Melanolepis multiglandulosa | | | | 1 | 0.025 | 0.016 | 2m | 0.01 | 0.015 | 0.031 |
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| | | | | | | | | | | |
| Totals | $\Sigma n =$ | $\Sigma ID =$ | $\Sigma RD = 1.0$ | | $\Sigma f = 1.525$ | $\Sigma Rf = 1.0$ | $\Sigma l = 132.8$ | $\Sigma IC = 0.469$ | $\Sigma RC = 1.0$ | |

* Data collected in these columns are from the totals on data sheet 3B.2. Data in the other columns are calculated from them.

8 **Data Sheet 3B.3.** *Class Summary of Data from Line-Intercept Plant Sampling*

Date 8 August 1986 Observers L. Rawlerson & A. Rinehart

Habitat and stratum

Locality Amer. Memorial Park Trauseet #3; 50 m sampled at 4 strata every 5 m Totals for all strata

Total transect length ($L$) 200 m

Total number of transect intervals 40

| Species ($i$) | Number of individuals ($n_i$) | Linear density index ($LD_i$) | Relative density ($RD_i$) | Present in how many transect intervals? ($f_i$)* | Frequency ($F_i$) | Relative frequency ($Rf_i$) | Intercept length ($l_i$)* | Linear coverage index ($IC_i$) | Relative coverage ($RC_i$) | Importance value ($IV_i$) |
|---|---|---|---|---|---|---|---|---|---|---|
| Acrostich. aureum | | | | 3 | 0.075 | 0.049 | 10.8 m | 0.054 | 0.081 | 0.130 |
| Pyrrosia lanceolata | | | | 1 | 0.025 | 0.016 | 1.0 m | 0.005 | 0.008 | 0.024 |
| Thespesia populnea | | | | 5 | 0.125 | 0.082 | 24.8 m | 0.124 | 0.187 | 0.269 |
| Polypodium scolopendria | | | | 6 | 0.150 | 0.098 | 4.9 m | 0.025 | 0.037 | 0.135 |
| Morinda citrifolia | | | | 3 | 0.075 | 0.049 | 2.8 m | 0.014 | 0.021 | 0.070 |
| Mikania scandens | | | | 2 | 0.050 | 0.033 | 6.5 m | 0.033 | 0.049 | 0.082 |
| Mucuna gigantea | | | | 4 | 0.100 | 0.066 | 5.0 m | 0.025 | 0.038 | 0.104 |
| Eupatorium odoratum | | | | 3 | 0.075 | 0.049 | 1.5 m | 0.008 | 0.011 | 0.060 |
| Pithecellobium dulce | | | | 3 | 0.075 | 0.049 | 2 m | 0.010 | 0.015 | 0.064 |
| Hibiscus fruticus | | | | 1 | 0.025 | 0.016 | 1 m | 0.005 | 0.008 | 0.024 |
| Ipomoea | | | | 2 | 0.050 | 0.033 | 0.5 m | 0.003 | 0.004 | 0.037 |
| Pandanus | | | | 9 | 0.225 | 0.148 | 23.3 m | 0.117 | 0.176 | 0.324 |

* Data collected in these columns are from the totals on data sheet 3B.2. Data in the other columns are calculated from them.

8 **Data Sheet 3B.3.** *Class Summary of Data from Line-Intercept Plant Sampling*

Date 8 August 1984 Observers _____

Habitat and stratum _____

Locality Ann. Mem. Park Transect #3 Bottom stratum

Total transect length ($L$) 50 m

Total number of transect intervals 10

| Species ($i$) | Number of individuals ($n_i$) | Linear density index ($ID_i$) | Relative density ($RD_i$) | Present in how many transect intervals? ($f_i$)* | Frequency ($f_i$) | Relative frequency ($Rf_i$) | Intercept length ($l_i$)* | Linear coverage index ($IC_i$) | Relative coverage ($RC_i$) | Importance value ($IV_i$) |
|---|---|---|---|---|---|---|---|---|---|---|
| Acrostichum aureum | | | | 3 | 0.353 | 0.217 | 10.8 m | 0.216 | 0.448 | 0.665 |
| Polypodium scolopendria | | | | 4 | 0.40 | 0.261 | 2.9 m | 0.058 | 0.120 | 0.381 |
| Mikania scandens | | | | 1 | 0.10 | 0.065 | 4.0 m | 0.080 | 0.166 | 0.231 |
| Mucuna gigantea | | | | 1 | 0.10 | 0.065 | 0.2 m | 0.004 | 0.008 | 0.073 |
| Eupatorium odoratum | | | | 2 | 0.20 | 0.131 | 1.0 m | 0.020 | 0.042 | 0.173 |
| Ipomoea | | | | 1 | 0.10 | 0.065 | 0.2 m | 0.004 | 0.008 | 0.073 |
| Hernandia sonora | | | | 2 | 0.20 | 0.131 | 3.5 m | 0.070 | 0.145 | 0.276 |
| Thelypteris opulenta | | | | 1 | 0.10 | 0.065 | 1.5 m | 0.030 | 0.062 | 0.127 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Totals | $\Sigma n$ = | $\Sigma ID$ = | $\Sigma RD = 1.0$ | | $\Sigma f = 1.533$ | $\Sigma Rf = 1.0$ | $\Sigma l = 24.1$ | $\Sigma IC$ = | $\Sigma RC = 1.0$ | |

* Data collected in these columns are from the totals on data sheet 3B.2. Data in the other columns are calculated from them.

8 **Data Sheet 3B.3.** *Class Summary of Data from Line-Intercept Plant Sampling*

Date _____ Observers _____

Habitat and stratum _____

Locality Amer. Mem. Park Transect #3 Lower stratum

Total transect length ($L$) 50 m

Total number of transect intervals 10

| Species ($i$) | Number of individuals ($n_i$) | Linear density index ($ID_i$) | Relative density ($RD_i$) | Present in how many transect intervals? ($f_i$)* | Frequency ($f_i$) | Relative frequency ($RF_i$) | Intercept length ($l_i$)* | Linear coverage index ($IC_i$) | Relative coverage ($RC_i$) | Importance value ($IV_i$) |
|---|---|---|---|---|---|---|---|---|---|---|
| Polypodium scolopendria | | | | 2 | 0.2 | 0.150 | 2 m | 0.04 | 0.124 | 0.274 |
| Morinda citrifolia | | | | 1 | 0.1 | 0.075 | 0.3 m | 0.006 | 0.019 | 0.094 |
| Mucuna gigantia | | | | 1 | 0.1 | 0.075 | 0.3 m | 0.006 | 0.019 | 0.094 |
| Eupatorium odoratum | | | | 1 | 0.1 | 0.075 | 0.5 m | 0.010 | 0.031 | 0.106 |
| Pandanus | | | | 3 | 0.333 | 0.250 | 5.3 m | 0.106 | 0.329 | 0.579 |
| Ficus tinctorius | | | | 1 | 0.1 | 0.075 | 2.5 m | 0.050 | 0.155 | 0.230 |
| Hernandia sonora | | | | 1 | 0.1 | 0.075 | 4 m | 0.080 | 0.249 | 0.324 |
| Leucaena leucocephala | | | | 2 | 0.2 | 0.150 | 1.1 m | 0.022 | 0.068 | 0.218 |
| Passiflora suberosa | | | | 1 | 0.1 | 0.075 | 0.1 m | 0.002 | 0.006 | 0.081 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Totals | $\Sigma n =$ | $\Sigma ID =$ | $\Sigma RD = 1.0$ | | $\Sigma f = 1.333$ | $\Sigma RF = 1.0$ | $\Sigma l = 16.1$ | $\Sigma IC = 0.375$ | $\Sigma RC = 1.0$ | |

* Data collected in these columns are from the totals on data sheet 3B.2. Data in the other columns are calculated from them.

8 **Data Sheet 3B.3.** *Class Summary of Data from Line-Intercept Plant Sampling*

Date _____ Observers _____

Habitat and stratum _____

Locality Amer. Mem. Park Transect #3 upper stratum

Total transect length ($L$) 50 m

Total number of transect intervals 10

| Species ($i$) | Number of individuals ($n_i$) | Linear density index ($ID_i$) | Relative density ($RD_i$) | Present in how many transect intervals? ($f_i$)* | Frequency ($f_i$) | Relative frequency ($Rf_i$) | Intercept length ($l_i$)* | Linear coverage index ($IC_i$) | Relative coverage ($RC_i$) | Importance value ($IV_i$) |
|---|---|---|---|---|---|---|---|---|---|---|
| Pyrrosia lanceolata | | | | 1 | 0.1 | 0.063 | 1.0 m | 0.020 | 0.026 | 0.089 |
| Morinda citrifolia | | | | 2 | 0.2 | 0.125 | 2.5m | 0.050 | 0.065 | 0.190 |
| Mucuna gigantea | | | | 1 | 0.1 | 0.063 | 3.0 m | 0.060 | 0.078 | 0.141 |
| Hibiscus tiliaceus | | | | 1 | 0.1 | 0.063 | 1.0m | 0.020 | 0.026 | 0.089 |
| Ipomoea | | | | 1 | 0.1 | 0.063 | 0.3m | 0.006 | 0.008 | 0.071 |
| Pandanus | | | | 4 | 0.4 | 0.250 | 12.5m | 0.250 | 0.326 | 0.576 |
| Ficus tinctoria | | | | 1 | 0.1 | 0.063 | 1m | 0.020 | 0.026 | 0.089 |
| Hernandia sonora | | | | 4 | 0.4 | 0.250 | 15.0m | 0.300 | 0.392 | 0.642 |
| Melanolepis multiglandulosa | | | | 1 | 0.1 | 0.063 | 2m | 0.040 | 0.052 | 0.115 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Totals | $\Sigma n$ = | $\Sigma ID$ = | $\Sigma RD = 1.0$ | | $\Sigma f = 1.60$ | $\Sigma Rf = 1.0$ | $\Sigma l = 38.3$ | $\Sigma IC = 0.766$ | $\Sigma RC = 1.0$ | |

* Data collected in these columns are from the totals on data sheet 3B.2. Data in the other columns are calculated from them.

8 **Data Sheet 3B.3.** *Class Summary of Data from Line-Intercept Plant Sampling*

Date _____ Observers _____

Habitat and stratum _____

Locality Amer. Mem. Park Transect #3 Top stratum

Total transect length ($L$) 50 m

Total number of transect intervals 10

| Species (i) | Number of individuals ($n_i$) | Linear density index ($ID_i$) | Relative density ($RD_i$) | Present in how many transect intervals? ($f_i$)* | Frequency ($f_i$) | Relative frequency ($Rf_i$) | Intercept length ($l_i$)* | Linear coverage index ($IC_i$) | Relative coverage ($RC_i$) | Importance value ($IV_i$) |
|---|---|---|---|---|---|---|---|---|---|---|
| Thespesia populnea | | | | 5 | 0.5 | 0.289 | 24.8m | 0.496 | 0.457 | 0.746 |
| Mikania scandens | | | | 1 | 0.1 | 0.058 | 2.5m | 0.050 | 0.046 | 0.624 |
| Mucuna gigantea | | | | 1 | 0.1 | 0.058 | 1.5 m | 0.030 | 0.028 | 0.086 |
| Pithecellobium dulce | | | | 3 | 0.33 | 0.191 | 2.0 m | 0.040 | 0.037 | 0.228 |
| Pandanus | | | | 2 | 0.2 | 0.116 | 5.5m | 0.110 | 0.101 | 0.217 |
| Hernandia sonora | | | | 5 | 0.5 | 0.289 | 18.0 m | 0.360 | 0.332 | 0.621 |
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| | | | | | | | | | | |
| Totals | $\Sigma n =$ | $\Sigma ID =$ | $\Sigma RD = 1.0$ | | $\Sigma f = 1.73$ | $\Sigma Rf = 1.0$ | $\Sigma l = 54.3$ m | $\Sigma IC = 1.086$ | $\Sigma RC = 1.0$ | |

* Data collected in these columns are from the totals on data sheet 3B.2. Data in the other columns are calculated from them.

(A)



**Data Sheet 3B.3.** *Class Summary of Data from Line-Intercept Plant Sampling*

Date 8 August 1984 Observers Rinehart & Raulerson

Habitat and stratum swamp, swamp forest, & associates; total of all 4 strata

Locality American Memorial Park, transect #4

Total transect length ($L$) 60m × 4 levels = 240m

Total number of transect intervals 12 × 4 levels = 48

| Species ($i$) | Number of individuals ($n_i$) | Linear density index ($ID_i$) | Relative density ($RD_i$) | Present in how many transect intervals? ($f_i$)* | Frequency ($F_i$) | Relative frequency ($RF_i$) | Intercept length ($l_i$)* | Linear coverage index ($IC_i$) | Relative coverage ($RC_i$) | * Importance value ($IV_i$) |
|---|---|---|---|---|---|---|---|---|---|---|
| Carica papaya | | | | 3 | 0.063 | 0.038 | 3.3m | 0.014 | 0.017 | 0.055 |
| Ingerata | | | | 2 | 0.042 | 0.025 | 0.8m | 0.003 | 0.004 | 0.029 |
| Phyllanthus maranius | | | | 2 | 0.042 | 0.025 | 1.1m | 0.006 | 0.007 | 0.032 |
| Hernandia sonora | | | | 4 | 0.083 | 0.050 | 15m | 0.0625 | 0.075 | 0.125 |
| Polyscias guilfoylei | | | | 3 | 0.063 | 0.038 | 2.2m | 0.009 | 0.011 | 0.049 |
| Leucaena leucocephala | | | | 2 | 0.042 | 0.025 | 1.3m | 0.005 | 0.007 | 0.032 |
| Casuarina equisetif. | | | | 9 | 0.188 | 0.113 | 40m | 0.167 | 0.201 | 0.314 |
| Pandanus dubius | | | | 16 | 0.333 | 0.199 | 59.5m | 0.248 | 0.299 | 0.498 |
| Mucuna gigantea | | | | 4 | 0.083 | 0.050 | 4.1m | 0.017 | 0.021 | 0.071 |
| Hymenocallis littoralis | | | | 6 | 0.125 | 0.075 | 12.3m | 0.051 | 0.062 | 0.137 |
| Acrostichum aureum | | | | 7 | 0.146 | 0.087 | 18.7m | 0.078 | 0.094 | 0.181 |
| Morinda citrifolia | | | | 1 | 0.021 | 0.013 | 0.5m | 0.002 | 0.003 | 0.014 |

* Data collected in these columns are from the totals on data sheet 3B.2. Data in the other columns are calculated from them

* does not include RDi

(AA)

8 **Data Sheet 3B.3.** *Class Summary of Data from Line-Intercept Plant Sampling*

Date 8 Aug 1986 Observers

Habitat and stratum total of all strata

Locality Asper. Mem. Park, transect #4

Total transect length (*L*) 60m x 4 levels = 240m

Total number of transect intervals 12 x 4 levels = 48

| Species (*i*) | Number of individuals ($n_i$) | Linear density index ($ID_i$) | Relative density ($RD_i$) | Present in how many transect intervals? ($f_i$)* | Frequency ($f_i$) | Relative frequency ($Rf_i$) | Intercept length ($l_i$)* | Linear coverage index ($IC_i$) | Relative coverage ($RC_i$) | Importance value ($IV_i$) |
|---|---|---|---|---|---|---|---|---|---|---|
| Hikanja scandens | | | | 2 | 0.042 | 0.025 | 0.9m | 0.004 | 0.005 | 0.030 |
| Aromolacua Odorata | | | | 1 | 0.021 | 0.013 | 3m | 0.013 | 0.015 | 0.028 |
| Hibiscus tiliaceus | | | | 6 | 0.125 | 0.075 | 14.4m | 0.060 | 0.072 | 0.147 |
| Bruguiera gymno | | | | 6 | 0.125 | 0.75 | 16m | 0.067 | 0.080 | 0.830 |
| Nephrol. | | | | 3 | 0.063 | 0.038 | 4.1m | 0.017 | 0.021 | 0.059 |
| Pyrrosia | | | | 1 | 0.021 | 0.013 | 0.4m | 0.002 | 0.002 | 0.015 |
| Pasoj. subtosa | | | | 2 | 0.042 | 0.025 | 1.4m | 0.006 | 0.007 | 0.032 |
| | | | | | | | | | | |
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| | | | | | | | | | | |
| | | | | | | | | | | |
| Totals | $\Sigma n =$ | $\Sigma ID = \frac{1}{\bar{t}_i}$ | $\Sigma RD = 1.0$ | (50) | $\Sigma f = 1.670$ | $\Sigma Rf = 1.0$ | $\Sigma l = 199.3$ | $\Sigma IC =$ | $\Sigma RC = 1.0$ | |

* Data collected in these columns are from the totals on data sheet 3B.2. Data in the other columns are calculated from them.

COMPLETED

8 **Data Sheet 3B.3.** *Class Summary of Data from Line-Intercept Plant Sampling*

Date 8 August 1986 Observers

Habitat and stratum swamp, swamp forest & associates; bottom (0-1m) stratum

Locality Am. Mem. Park, transect #4

Total transect length ($L$) 60m

Total number of transect intervals 12

| Species ($i$) | Number of individuals ($n_i$) | Linear density index ($ID_i$) | Relative density ($RD_i$) | Present in how many transect intervals? ($f_i$)* | Frequency ($f_i$) | Relative frequency ($Rf_i$) | Intercept length ($l_i$)* | Linear coverage index ($IC_i$) | Relative coverage ($RC_i$) | * does not include RD; * Importance value ($IV_i$) |
|---|---|---|---|---|---|---|---|---|---|---|
| Imperata conferta | | | | 2 | 0.167 | .077 | 0.8m | 0.01 | 0.017 | 0.094 |
| Polypod 3 Colopend | | | | 2 | 0.167 | .077 | 1.4m | 0.02 | 0.030 | 0.107 |
| Mucuna gigantea | | | | 1 | 0.083 | .038 | 0.6m | 0.01 | 0.017 | 0.055 |
| Hymenocallis littoralis | | | | 6 | 0.5 | .231 | 12.3m | 0.205 | 0.260 | 0.491 |
| Acrostichum aureum | | | | 7 | 0.583 | .269 | 18.7m | 0.312 | 0.395 | 0.664 |
| Chromolaena odorata | | | | 1 | 0.083 | .038 | 3m | 0.05 | 0.063 | 0.101 |
| Bruguiera gymnorhiza | | | | 2 | 0.167 | .077 | 3m | 0.05 | 0.063 | 0.140 |
| Nephrolepis hirsutula | | | | 3 | 0.25 | .115 | 4.1m | 0.068 | 0.087 | 0.202 |
| Pandanus tectorius | | | | 1 | 0.083 | .038 | 3.5m | 0.058 | 0.074 | 0.112 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Totals | $\Sigma n =$ | $\Sigma ID =$ | $\Sigma RD = 1.0$ | | $\Sigma f = 2.166$ | $\Sigma Rf = 1.0$ | $\Sigma l = 47.4$ | $\Sigma IC = 0.783$ | $\Sigma RC = 1.0$ | |

* Data collected in these columns are from the totals on data sheet 3B.2. Data in the other columns are calculated from them.

**Data Sheet 3B.3.** *Class Summary of Data from Line-Intercept Plant Sampling*

Date 8 August 1986 Observers

Habitat and stratum swamp, swamp forest & associates; lower stratum (1-3m.)

Locality Amer. Memor. Park, Transect #4

Total transect length (*L*) 60m

Total number of transect intervals 12

| Species (*i*) | Number of individuals ($n_i$) | Linear density index ($ID_i$) | Relative density ($RD_i$) | Present in how many transect intervals? ($f_i$)* | Frequency ($f_i$) | Relative frequency ($Rf_i$) | Intercept length ($l_i$)* | Linear coverage index ($IC_i$) | Relative coverage ($RC_i$) | Importance value ($IV_i$) * |
|---|---|---|---|---|---|---|---|---|---|---|
| Carica papaya | | | | 2 | 0.167 | 0.091 | 1.3m | 0.022 | 0.032 | 0.123 |
| Phyllanthus mananas | | | | 2 | 0.167 | 0.091 | 1.4m | 0.023 | 0.035 | 0.126 |
| Hernandia sonora | | | | 1 | 0.083 | 0.045 | 3.5m | 0.058 | 0.087 | 0.132 |
| Leucaena leucocephala | | | | 1 | 0.083 | 0.045 | 0.3m | 0.005 | 0.008 | 0.053 |
| Pandanus dubius | | | | 6 | 0.5 | 0.273 | 18.5m | 0.308 | 0.461 | 0.734 |
| Morinda citrifolia | | | | 1 | 0.083 | 0.045 | 0.5m | 0.008 | 0.012 | 0.057 |
| Mikania scandens | | | | 1 | 0.083 | 0.045 | 0.8m | 0.013 | 0.020 | 0.065 |
| Hibiscus tiliaceus | | | | 4 | 0.333 | 0.182 | 7.4m | 0.123 | 0.185 | 0.367 |
| Bruguiera gymnorhiza | | | | 2 | 0.167 | 0.091 | 5m | 0.083 | 0.125 | 0.216 |
| Maytenus suberosa | | | | 2 | 0.167 | 0.091 | 1.4m | 0.023 | 0.035 | 0.126 |
| | | | | | | | | | | |
| Totals | $\Sigma n_i =$ | $\Sigma ID_i =$ | $\Sigma RD_i = 1.0$ | | $\Sigma f_i = 1.833$ | $\Sigma Rf_i = 1.0$ | $\Sigma l_i = 40.1$ | $\Sigma IC_i = 0.466$ | $\Sigma RC_i = 1.0$ | |

* Data collected in these columns are from the totals on data sheet 3B 2. Data in the other columns are calculated from them.

*does not include RDi

8 **Data Sheet 3B.3.** *Class Summary of Data from Line-Intercept Plant Sampling*

Date 8 August 1986 Observers

Habitat and stratum upper stratum (3-10 m)

Locality Ann. Hem. Park, Trausect # 4

Total transect length (*L*) 60 m

Total number of transect intervals 12

| Species (*i*) | Number of individuals ($n_i$) | Linear density index ($ID_i$) | Relative density ($RD_i$) | Present in how many transect intervals? ($f_i$)* | Frequency ($f_i$) | Relative frequency ($Rf_i$) | Intercept length ($l_i$)* | Linear coverage index ($IC_i$) | Relative coverage ($RC_i$) | Importance value ($IV_i$) * |
|---|---|---|---|---|---|---|---|---|---|---|
| Cauca papaya | | | | 1 | 0.083 | 0.055 | 2m | 0.033 | 0.034 | 0.089 |
| Hernandia Sonora | | | | 2 | 0.167 | 0.111 | 6.5m | 0.108 | 0.110 | 0.221 |
| Polypod. sclopend. | | | | 1 | 0.083 | .0.55 | 0.8m | 0.013 | 0.014 | 0.069 |
| Leucaena leucocph. | | | | 1 | 0.083 | .0.55 | 1m | 0.017 | 0.017 | 0.072 |
| Pandanus dubius | | | | 9 | 0.750 | 0.500 | 37.5m | 0.625 | 0.635 | 1.135 |
| Mucuna gigantea | | | | 1 | 0.083 | 0.055 | 0.8m | 0.013 | 0.014 | 0.069 |
| Hybiscus. tiliaceus | | | | 2 | 0.167 | 0.111 | 7m | 0.117 | 0.118 | 0.229 |
| Bruguiera gymnorhiza | | | | 1 | 0.083 | 0.055 | 3.5 | 0.058 | 0.060 | 0.115 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Totals | $\Sigma n$ = | $\Sigma ID$ = | $\Sigma RD = 1.0$ | | $\Sigma f = 1.499$ | $\Sigma Rf = 1.0$ | $\Sigma l = 59.1$ | $\Sigma IC = .984$ | $\Sigma RC = 1.0$ | |

* Data collected in these columns are from the totals on data sheet 3B.2. Data in the other columns are calculated from them.

* does not include

59

8 **Data Sheet 3B.3.** *Class Summary of Data from Line-Intercept Plant Sampling*

Date 8 August 1986 Observers

Habitat and stratum top stratum (>10 m)

Locality Amer. Mem. Park, Transect #4

Total transect length (*L*) 60 m

Total number of transect intervals 12

| Species (*i*) | Number of individuals ($n_i$) | Linear density index ($ID_i$) | Relative density ($RD_i$) | Present in how many transect intervals? ($f_i$)* | Frequency ($f_i$) | Relative frequency ($Rf_i$) | Intercept length ($l_i$)* | Linear coverage index ($IC_i$) | Relative coverage ($RC_i$) | Importance value ($IV_i$) |
|---|---|---|---|---|---|---|---|---|---|---|
| Hernandia sonora | | | | 1 | 0.083 | 0.083 | 5 m | 0.083 | 0.100 | 0.183 |
| Casuarina equisetif. | | | | 9 | 0.75 | 0.751 | 40 m | 0.667 | 0.807 | 1.558 |
| Mikania scandens | | | | 1 | 0.083 | 0.083 | 0.1 m | 0.002 | 0.002 | 0.085 |
| Bruguiera gymnorhiza | | | | 1 | 0.083 | 0.083 | 4.5 m | 0.075 | 0.091 | 0.174 |
| | | | | | | | | | | |
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| | | | | | | | | | | |
| Totals | $\Sigma n =$ | $\Sigma ID =$ | $\Sigma RD = 1.0$ | | $\Sigma f = 0.999$ | $\Sigma Rf = 1.0$ | $\Sigma l = 49.6$ m | $\Sigma IC = 0.827$ | $\Sigma RC = 1.0$ | |

* Data collected in these columns are from the totals on data sheet 3B.2. Data in the other columns are calculated from them.

## APPENDIX 2. PHOTO ESSAY

In December 1986 Typhoon Kim struck Saipan. Erosion of the jetties, fallen trees and other debris changed the face of the park. During fall 1988 the explosion of an old bomb in the municipal dump caused a death and prompted the temporary closing of the dump. People looked for alternate, though unsanctioned dumping sites; some sections of the park were close to the dump and were used.

During 1-3 January, 1989, Lynn Raulerson and Agnes Rinehart visited the park to assess storm damage and conditions in the park. The photographs which follow are the result of that visit.

### STORM DAMAGE

Figures A1 and A2. The roots of many trees such as Casuarina equisetifolia are exposed and the trees fall as storms erode the unprotected parts of the jetties within the park. Garbage has washed or blown in from the nearby municipal dump.

Figure A3. An old sewer pipe is exposed, (far left) as a section of the jetty washed away. Roads and picnic areas are threatened. The general disrepair of the area is an eyesore viewed by tourists and all who use the waterway on the extreme right.

Figure A4. Casuarina trees standing alone and taller than the other vegetation in the mangrove area of the park fell victim to the winds of Typhoon Kim. Fallen trees rendered some sections of the park almost impassable.

USES

That portion of the park which adjoins the tourist hotels and popular Micro Beach is well kept and receives a lot of use.

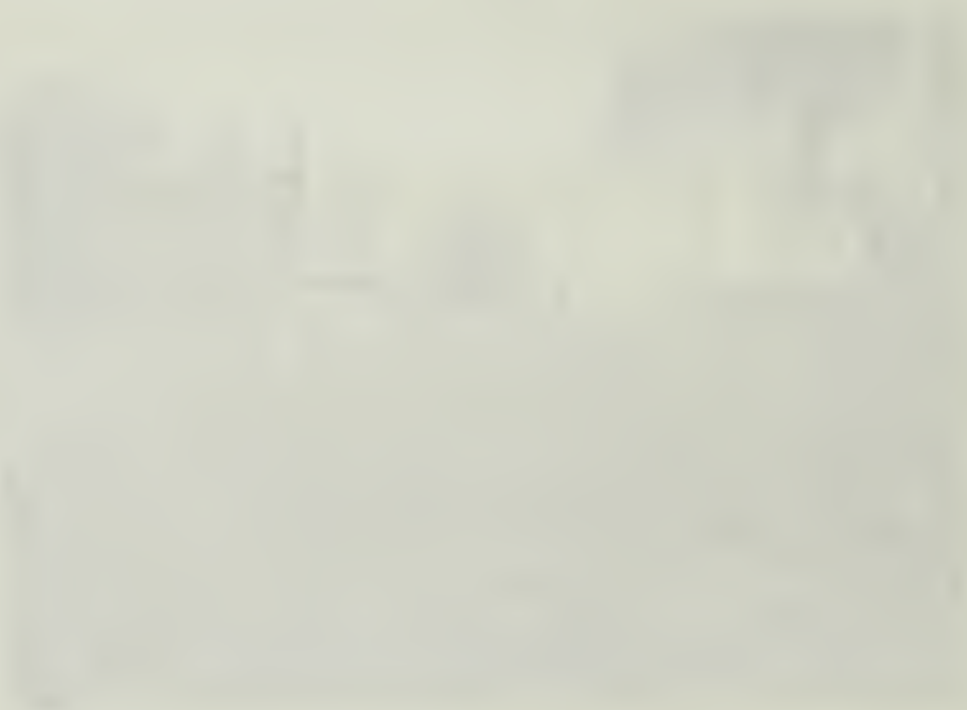

Figures A5 and A6. Saipan residents enjoy an afternoon softball game in American Memorial Park.

Figure A7. The corner of the park between the road and the mangrove swamp is a popular meeting place.


Figure A8. Buildings within the park boundaries are used for Judo and other activities.

Figure A9. Boats are docked along the park boundaries and tourists embark for a day at nearby Managaha Island or to go deep-sea fishing.

Figure A10. The Marianas gallinule was seen emerging from this scirpus marsh near the hotels.

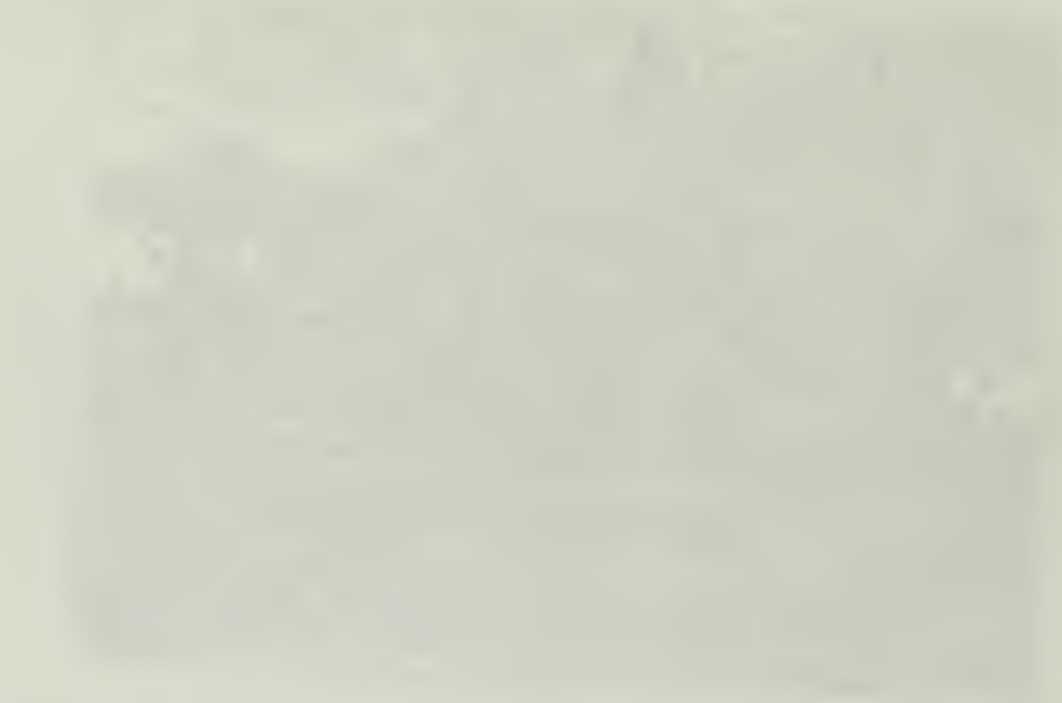



Figures A11 and A12. Caulerpa, an algae which is eaten locally, is collected in the water in front of the American Memorial Park obelisk. Managaha Island can be seen in the background.

Figures A13 and A14. The mangrove and marsh areas receive less human use than other sections of the park. They are important habitats for birds, lizards, crabs and other small animals and they provide accessible examples of unique vegetation. The mangroves together with the rest of the forested area have potential as a nature study area.

Figure A15. The park's historical resources include a small outdoor museum of WWII artifacts which will need some attention if items are to be preserved.

Figure A16. Across Beach Road from the manicured section of the park and near the mangroves, an old bomb and 21 smaller explosive devices can be seen with more modern beverage cans. The artifacts were reported; and hopefully, these potential threats to unwary hikers and curious children have been removed.




Figures A17 and A18. The practice of dumping in the wooded areas and jetties of the park has apparently persisted since WWII. Unsightly and potentially harmful objects should be removed as they invite more dumping and make the park an unpleasant place to visit. Dumps within the boundaries of the American Memorial Park make it an inappropiate memorial and an insult to the National Park Service.

Figures A19 and A20. Thickets of Hibiscus tiliaceus (pago or wild hibiscus) make the wooded area of the park almost impassable. Evidence of a long history of poor stewardsmanship and abuse of the land is everywhere. Piles of roofing material, old tires, and metal objects decompose at the edge of the swamp. Old sewer pipes and other objects litter the area.

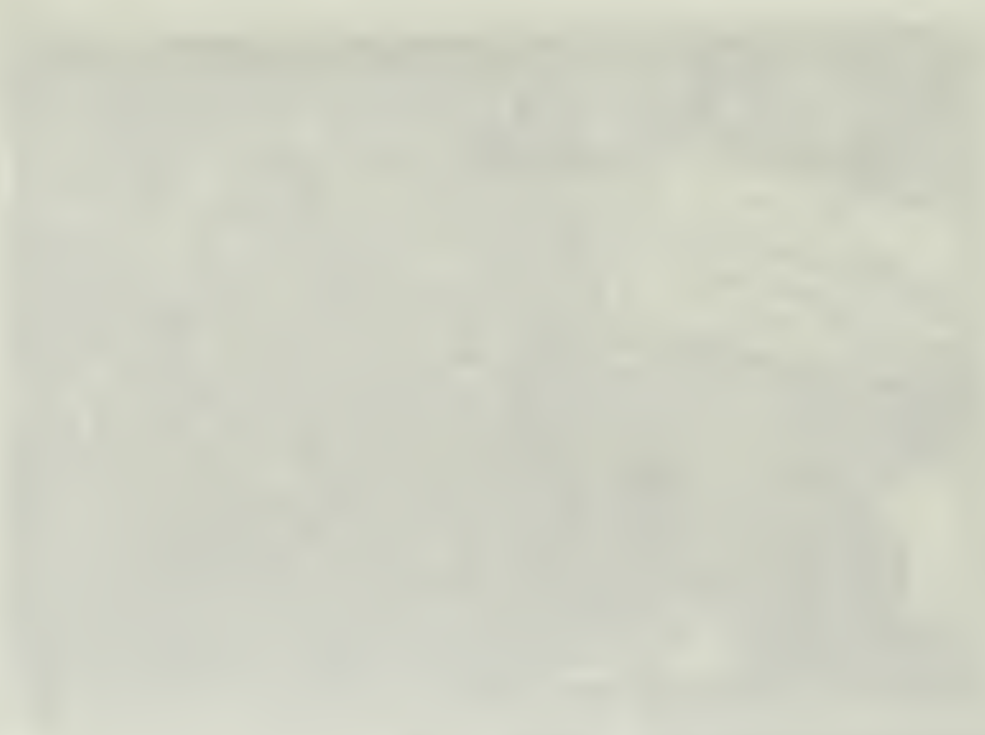


Figure A21. Old dump sites and unclean areas invite more dumping. Paths and roadways which once formed the exercise trail are used as dumping areas.

Figure A22. The edge of the park which fronts Middle Road is a dry area. Leucaena leucocephala is covered with Eupatorium and other weeds which burn readily during the dry season.

Figure A23. The inscription on the marble monument reads: "THIS MEMORIAL HAS BEEN ERECTED BY THE UNITED STATES OF AMERICA IN HUMBLE TRIBUTE TO ITS SONS WHO PAID THE ULTIMATE SACRIFICE FOR THE LIBERATION OF THE MARIANAS 1941-1945."


Figure A24. Less than one half mile south of the monument piles of garbage litter the area. Tribute?